Mobile technologies in the banking sector in the Republic of Croatia

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MOBILE TECHNOLOGIES IN THE BANKING SECTOR IN THE REPUBLIC OF CROATIA

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Abstract
The past decade bore witness to fast-paced development of digital technologies, especially in the domain of mobile technologies. The banking sector, renowned for being quite traditional and not in favor of frequent changes, is also adapting to new market trends. New FinTech technologies emerged, technologies that intensively use information-communication and digital technologies to transform traditional business practices of the banking sector. The present paper deals with FinTech technologies, mobile business practices of banks and numerous innovations in mobile banking apps. The primary research that was conducted on a sample of mobile banking users in the Republic of Croatia shows how mobile banking is used and the respondents' views on how digital technologies in the banking sector would be used in the future.

Keywords: mobile technologies, FinTech, banking sector, mobile apps

JEL classification: M15, M21

Introduction

The application of technology and innovation in banking is taking place almost in parallel to the discovery of these new technologies. Ever since the early 1980s, with the introduction of the first model of "online banking", through the 1990s, up to the early 2000s, with its technological revolution and the internet and the use of smartphones, banks have constantly been switching between various business practices in line with the technological innovations that have been developing in and around them. Diamond et al. (2017) claim that the face of present-day banking is changing primarily due to the following: (1) widespread digitalization, in combination with ubiquitous mobility and cloud computing, massive progress in the field of artificial intelligence and cognitive computing and (2) customer base in retail and institutional segments which is technologically more sophisticated and more demanding.

Mobile financial services represent an all-inclusive service portfolio for consumer segments accessing and using retail and business-related banking and payment services on mobile devices (Shaikh et al., 2023).

FinTech technologies

The development of digital technologies led to the emergence of FinTech (short for Financial Technology). This is a new form of technology and innovation at the financial market aimed at supplementing and improving traditional banking services such as receiving deposits and loan placement. FinTech would not have been possible had there not been progress in new technologies, drastic reduction in prices of hardware and software solutions and the support for various open-source code initiatives. All of this, in turn, led to an explosion of innovations that support and develop FinTech solutions (Rafal, 2019). In addition to the benefits listed above, FinTech facilitates the delivery of financial products and services, the creation of new and innovative financial products and services, as well as the digitalization and re-engineering of front-, middle-, and back-office processes both within and among financial institutions to enhance their efficiency and productivity (European Commission, 2019).

The importance of FinTech is visible in the orientation of financial institutions and global organizations (such as the European Union) toward such innovative technology. Hence, the European Commission (EC) lists as one of the definitions of FinTech the following: "an expression used to describe the influence of new technologies on the financial services industry. This term pertains to various products, apps, processes and business models that transformed the traditional way of providing banking and financial services. Artificial intelligence, social media, machine learning, mobile apps, blockchain technology, cloud computing and big data analysis created new services and business models for well-established financial institutions and new market players. All these technologies are extremely useful to both customers and companies as they enable them better access to financial services, offer more options and increase business efficiency. They can also contribute to reducing national obstacles and increasing competition in areas such as online banking, online payment and transfer services, loans, personal investment consultancy and services, etc." (European Commission, 2020).

Research conducted in 2019 by FinTech Capital and Dealroom.com has shown that between 2017 and 2019 FinTech was Europe's largest investment category, taking up 20% of all global investments in Europe, while the Fintech sector was more active in Europe than in Asia or USA. In addition, the report stated that FinTech generated 150 billion EUR in value, created numerous jobs and better experience and products for European consumers (see: FinTech Capital & Dealroom.co, 2019). The next wave supported by FinTech is expected to be less visible as it will focus more on infrastructure and development, but its growth should be even greater as it will combat the inefficiencies of the financial industry.

Numerous researches have been conducted in recent years regarding the use of FinTech. Some of the more interesting pieces of research are listed below. Stewart & Jürjens (2018) identify the key factors that influence and drive FinTech adoption. These factors include data security, customer trust, user interface design, added value, and FinTech promotion (Stewart & Jürjens, 2018). Lin & Lee provided a list of key features for banks to use for evaluating mobile banking services, especially for the banks which plan to implement artificial intelligence technology to mobile banking services (Lin & Lee, 2023). Qi et al. (2024) provide empirical evidence that individuals with high FinTech proficiency and a high tolerance for risk are more likely to adopt new FinTech products. Baig et al. (2024) confirmed that FinTech innovation positively and significantly impacts firm performance. Their findings reveal a connection between FinTech innovations and knowledge assets (Baig et al., 2024). According to Osmani

et al. (2021), banks have been exploring the use of blockchain technology for clearing and settlement, trade finance, and syndicated loans. The main reason for adopting blockchain is its significantly lower cost and much faster transaction processing time (Osmani et al., 2021). Kassner (2024) concludes that the FinTech industry is heavily influenced by financial investors who seek high returns and, consequently, view FinTech merely as an alternative to other investment opportunities.

According to Alfawareh & Al-Kofahi (2023), FinTech exemplifies how technological advancements are disrupting traditional service delivery methods. Various software and applications should be designed to enhance competitiveness and complementarity with the traditional financial system, while also incorporating new technologies to deliver traditional services (Alfawareh & Al-Kofahi, 2023). Rani & Kumar (2023) stated that FinTech has developed more advanced financial services, such as insurance through websites, crowdfunding, peer-to-peer (P2P) lending, wealth management for users, and modern payment methods like quick response (QR) codes and mobile banking. Koziel & Shen (2023) have developed a framework that serves as a valuable tool for banks, FinTech companies, and other stakeholders to understand and engage with customers in the dynamic mobile FinTech services market. This framework can help in devising better strategies for consumer engagement and retention (Koziel & Shen, 2023). Campanella et al. (2023) suggest that contemporary FinTech companies should allocate more resources to enhancing their green image, as it is positively linked to trust and customer satisfaction. They recommend incorporating sustainable development and green strategies into their planning, as environmental and sustainability concerns increasingly influence consumers, who now consider non-financial attributes like environmental, social, and governance criteria in their investments (Campanella et al., 2023). According to Ben Bouheni et al. (2023), technology developed by tech companies has consistently disrupted the traditional financial services industry by impacting financial transactions.

In parallel with the development of FinTech, other questions arise related to legislative regulation and international agreements, for instance, why are bank clients still unable to conduct all desired activities via their mobile phones? They could in theory, but the problem is how to verify that a specific client is using a service. For this reason, one direction in which banking technology is developing is client identification through biometric information; however, these processes are also limited by international regulations on preventing money laundering and the know-your-client principle, which stipulates presence in person and handwritten signature of the contract. Yudaruddin (2024) stated that government regulators should encourage the adoption and advancement of new technological innovations and enhance regulatory frameworks under the supervision of commercial banks and FinTech startups to ensure fair competition between them. Additionally, regulators should continuously monitor and evaluate the evolving landscape of FinTech startups and their impact on the banking industry (Yudaruddin, 2024).

Due to all this and arising from the development of technology and legal restrictions in banking, alternative FinTech channels of financial operations are being developed which do not need to follow strict legal rules as in banking proper. For instance, FinTech channels do not require presence in person or, to put it more accurately, it is not strictly regulated. Banks consider the development of such technologies a threat to their future business as, compared to them, large technological giants can offer cheaper and more hack-proof services (for instance, money transfers), while smaller platforms can provide some other financial services without applying strict rules regarding risk assessment.

On the other hand, instead of focusing on defending and protecting themselves from new competitors, traditional financial institutions are in a position to embrace the changes and adjust their operations to new circumstances at the financial market. Hence, the banking sector's intense focus on reducing costs and increasing efficiency is slowly giving way to expansion and growth, which are increasingly going beyond the confines of traditional search for new markets and customers. Leading banking institutions are placing more emphasis on creating secure platforms and ecosystems, while new options are relying on sophisticated digital technologies. In other words, when designing and creating structures that would define the future of banking, banks are once again thoroughly considering their roles and activities – this process has been labelled *digital reinvention* (Diamond et al., 2017).

Traditional banking functions such as receiving deposits and providing loans are being challenged. As a consequence, banks focus much more on relations rather than on traditional functional abilities. However, even though emerging competitors might be able to copy the banks' functions more accurately and at a much lower price, it will be much harder for them to build and manage all the intricacies of the client relations that traditional banks have been carefully developing for decades. These relations enable traditional bankers to switch the focus from merely providing the services to making them easier and orchestrating them. In other words, banks can label themselves as their clients' gatekeepers, creating an infinite ecosystem of services and experiences. However, to do that, traditional banks will have to swiftly transform and connect to an expanding portfolio of business partners. Furthermore, bank managers can position their organizations in the center of rapidly growing banking ecosystems. Even though, when it comes to providing special functionalities, FinTech companies can make use of new technologies to compete with banks, they still did not build the same type of relationship with their clients as traditional banks did. Banks have traditionally created value to their clients through special banking functions or services they provided, but in the future, in which these services can easily be replicated, the banks will have to direct their values to the quality of the client relation (Brill et al., 2015). Souiden et al. (2021) offer a thorough review of mobile banking services, analyzing the key determinants and barriers to consumer adoption.

For this reason, Diamond et al. (2017) argue that due to greater degrees of personal experience and expertise in compliance and regulation and deeper and wider client relations, banks are increasingly forming more partnerships with FinTech companies, investing in or taking over the more successful and dynamic FinTech companies, which puts them in the position of ecosystem orchestrators which create the platform, environment and management through which third parties (such as FinTech companies) can participate, collaborate and innovate for the benefit of their clients, other partners in the ecosystem as well as for their own benefit. In addition, they highlight that due to the growth in the number of actors in this ecosystem, banks are forced to change their ways. The first effect of this is that their activities are becoming more dynamic and specialized and apart from orchestrating, banks are starting to act more as specialized service providers and mediators between buyers, service providers and sellers. Second of all, banks are increasingly acting as distributors rather than the initiators of a business relation with their clients. Since it took decades to build these channels and relations, banks are expected to use their own channels to distribute innovative products that had already been built by their partners in the ecosystem. The third effect, also in line with the forces that promote greater degrees of specialization, is that banks are assuming the role of property or instrument factory, creating new products that are distributed via their partners in the ecosystem as well as through their own platforms (see Diamond et al., 2017). Laksmana et al. (2023) argue that one of the competitive advantages of FinTech firms lies in their ability to expand the financial

market to unserved or underserved populations by offering faster and more affordable services through the use of ICT and digital technologies.

Innovations in mobile banking apps

All financial market players, banks being no exception, were forced to adapt their business activities to new circumstances and their clients' needs, including their own product and service sales and distribution channels. Throughout history, bank offices, or windows more specifically, used to be the only and traditional channel for selling and distributing banking services. Decentralization and a wide network of branch offices enabled banks to increase their share of the market. "Such an approach enabled them to offer homogeneous (standardized) products at a large number of places but also to employ large numbers of people. Since their fixed and variable costs were high, they had to minimize expenses. At the same time, since "entrance fees" for new banking service providers were high, they were safe from competition, which led to an oligopolistic structure of the banking market. This meant that clients had to adapt to the bank rather than vice versa, for instance when it comes to opening hours or choice of products and services and prices (interest rates, fees, etc.). Banks focused more on changes in the profit-and-loss account rather than the needs and values required by the client" (Rončević, 2006).

Direct contact with the client can be considered a type of competitive advantage for banks. By studying and monitoring their clients' behavior patterns, banks can better understand their needs, products, services and distribution process toward the end user. Direct contact with consumers allows the bank to understand their needs better, have greater control over the entire distribution process, gather ideas for new services, offer additional tailor-made services, provide counselling to their customers and have greater impact on the purchasing process. However, according to Beke (2016), any shortcoming will strongly impact the customers' satisfaction level and the bank's image, which will have a long-term effect on its profitability.

Contrary to the traditional approach referred to above, present-day banks are looking for new distribution and sales channels, discouraging clients to visit their branch offices in person to use services that can be consumed on their own, with no assistance from bank clerks. One example of this is the introduction of the fee for withdrawing cash at bank windows in 2019 (Sučec, 2019). Modern distribution and sales channels also include cash machines, card transactions, Electronic Fund Transfer at Point Of Sale (EFT/POS), online banking and mobile banking (Marković, 2019).

Cash machine is an electro-mechanic device that enables users of payment instruments to withdraw and/or deposit cash, transfer funds, get information about their account balance and other services (CNB, 2020b).

Card (bank card) is a plastic card with a magnetic strip that contains a machine-readable identification number and is issued by a foreign bank or card company. Bank cards are used for electronic transactions at POS (Point-of-Sale) terminals or online and for transactions via cash machines (Moj bankar, 2020).

ETF/POS device is an electronic device that enables bank card holders to initiate card payments at a point of sale. Two types of cards are in circulation – contact cards and contactless-contact cards. CNB states that contact EFT/POS devices support the use of bank cards whose records are contained in the form of a microchip and/or magnetic strip (CNB, 2020g). Contactless-

contact EFT/POS devices support the use of bank cards whose records are contained in the form of a magnetic strip/microchip but can also be read through contactless technology (proximity card reading, NFC, etc.).

Banks have been developing mobile banking since 2010. Revolut is a virtual bank that, apart from standard banking functionalities in Croatia, also offers additional features such as fractional stock trading at American stock markets, cryptocurrency trading and raw materials trading (such as gold and silver). In addition, Revolut enables its users to withdraw cash from any cash machine free of charge (regardless of who owns the cash machine), favorable currency exchange rates and opening accounts without setting foot in a bank. Apart from a physical bank card, the mobile app offers a virtual card that can be connected to the mobile wallet on the user's phone (Revolut, 2020).

Voice banking first appeared in 2014 and has been on the rise since 2017. US Bank, Bank of Canada and Barclays in the UK were some of the first banks to use this feature (Hartung, 2018). Voice banking enables its users to complete various banking activities, such as making payments, checking balance or checking a specific transaction. Some of the most well-known voice-activated digital assistants include Alexa by Amazon, Siri by Apple, Bixby by Samsung and Google Assistant (Mercury processing services international, 2018).

The Spanish-based Banco Bilbao Vizcaya Argentaria, S.A., (BBVA) offers a functionality in its mobile app under the name Bconomy, which assists users to set and monitor their financial objectives, save money and keep track of their progress. In addition, the app also proposes suggestions on how to save money and compares the client's living costs (e.g. utility and groceries) with other mobile app users that live in the same area (city, suburb). BBVA bank and Bconomy make it easier for their clients to obtain personalized financial advice no matter where they are located (Morgan, 2018). In addition to this, the bank's mobile app also features a functionality called Valora, which enables the client to assess the value of their real property as well as the value of real property or vehicles of interest to the client, offering various budget options in case of purchase or rental (BBVA Valora, 2020).

According to Lynch, cardless cash machines first appeared in 2017 in order to improve user experience in terms of increasing clients' convenience as these machines use mobile apps to initiate cash withdrawal (Lynch, 2018). The technology used for the interaction between the user and the machine can vary. Some cash machines use a scanner to read simple QR codes, others demand verification by a control code sent via SMS, while the most sophisticated ones can verify the user's authenticity by scanning their facial features or palm. Cardless cash machines can at the same time be contactless, functioning in such a manner that the mobile phone is placed above the contactless symbol to enable withdrawal of funds from the selected bank card (PaySpace Magazine, 2019).

Bank of America introduced its virtual assistant Erica, run by artificial intelligence, in 2016. Erica is a chatbot which interacts with the client by exchanging voice or text messages and learns the client's habits by doing so. The mobile app has improved over the years, leading to the chatbot in question being able to offer its clients a wide range of financial assistance today – paying bills, monitoring spending, setting reminders for payments that are due, locking the credit and debit card (Taylor, 2016).

Mobile apps of banks can be used by their clients that own a current or gyro account and an adequate mobile phone (adequate in the sense of meeting minimum technical requirements of

a specific operating system – iOS or Android). Before clients are able to use mobile apps, digital banking services need to be contracted (some banks use the term online banking or internet banking), which is subject to a specific fee. The mobile app can be downloaded to the client's phone via Apple Store or Google Play, depending on the client's mobile phone operating system. The bank generates registration keys for activating the mobile app and forwards them to the client. Upon registration, which can take several minutes, the client can use the mobile app. Two levels of the app need to be clearly distinguished – public and private interfaces. Every time the client opens the mobile banking app, they are first welcomed to the public interface, which can be used without registration or authentication. If they want to access the private interface, the client should verify their identity either by entering their PIN or some other form of identification, e.g. biometrical features – fingerprints or facial scanning. Upon successful identification and authentication, the user is allowed access to the mobile app's private user interface.

The functionalities of public interfaces of mobile apps offered by banks include:

(1) Cash machine and branch office locator – the user is shown the location of cash machines or bank branch offices closest to the current location transmitted by the user's phone. When using this functionality, the user should allow the mobile app the use of location services via the phone's location services (only upon first-time use), (2) Currency exchange rate – showing the buying, middle and selling rates of a foreign currency on a specific day in the present or past, (3) Product information – this is usually related to further instructions and information about specific products such as savings, loans, opening accounts, insurance, etc. This information is usually accompanied by hyperlinks to the bank's/insurance company's website where the user would be able to find additional information, (4) Access to mobile token – this token generates one-time codes that are used, for instance, to sign in to online banking or make payments at virtual points of sale where users are required to verify their identity. Before first use, this functionality needs to be activated (through registration and activation codes), and on any further use the functionality requires additional authentication to provide access to the private interface of the app, (5) Useful contacts – phone numbers, email addresses or URLs of the bank for customer support. Some banks provide contact details of their branch offices, the clients' personal banker, card support, bank funds (for investment transactions), etc., (6) Quick payments without entering the recipient's International Bank Account Number (IBAN) – the payer selects the recipient by entering their phone number or selecting an existing contact from their phone book; the transaction is completed free of charge for the payer. Some of the studied banks limit such transactions only to users of their own mobile app. This functionality requires additional authentication (same as for accessing private interface of the mobile app), (7) Cardless cash withdrawal at cash machine – upon selecting the amount and the time limit (10-60 minutes), this functionality generates a one-time code that can be entered at any cash machine run by the bank. This functionality requires additional client authentication (same as for accessing private interface of the mobile app).

Functionalities of the closed interface of mobile apps can be categorized into the following:

(1) Account balance: the bank's client can check their current balance and past transactions for all accounts they are authorized for. Transactions can be filtered by period, type of transaction, amount, keyword, etc., (2) Payment: several options are available for executing payments – by scanning a payment order, by manually entering payment information or quick payment as described above, (3) Savings overview: balance, interests, maturity dates and transactions on savings and deposits and savings in which the client is the proxy. Some banks allow for savings

contracts to be concluded via their mobile app without physically visiting the bank, (4) Investment overview: checking balance and trends in prices of the client's own shares in investment funds or making investments in the bank's investment funds as well as other useful information on individual funds for interested investors, (5) Loans: information about the loan's condition: amount, due interest and principal amount, monthly annuity amount, number of annuities and the loan's due date at a specific moment. Apart from the above, some banks additionally offer specific information for new loan holders (such as loan calculator or additional loan-related information), while some banks also enable loans to be contracted without physically visiting the bank, (6) Phone top-ups (GSM vouchers): buying top-ups for various telecommunication providers, Croatian motorway company (HAC), etc. Vouchers are available for purchase in several values and upon payment, the client receives an activation code which they can use themselves or forward to another user, (7) Currency exchange: a certain currency can be converted from the user's current account to their foreign currency account and vice versa.

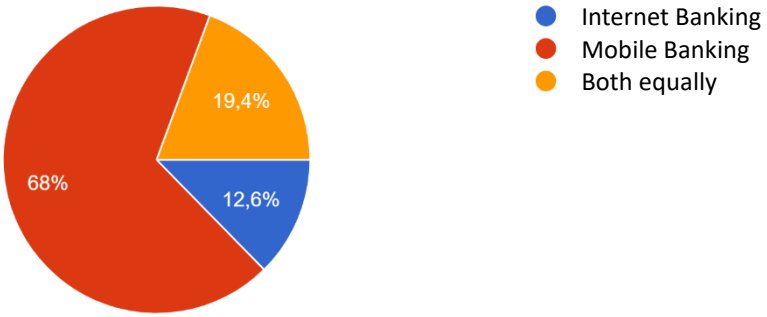
Methodology and sample description

To investigate the satisfaction levels of mobile technology users in the Croatian banking sector, we created a questionnaire. The primary research question (**RQ1**) aims *to explore how users in Croatia utilize bank mobile applications, identify the most important functionalities they currently use, and determine what additional features they would like to have in the future*. The survey was conducted from January 25, 2021, to February 19, 2021. Respondents were eligible to participate if they used any form of digital banking (online or mobile banking). Before completing the questionnaire, respondents were informed that it was anonymous, that it would be used for writing a postgraduate expert thesis, and about the estimated completion time. The questionnaire was created using the Google Forms tool, available through Google Drive. It consisted of 29 closed-ended questions. Twenty-two questions were multiple-choice with only one answer allowed. Two questions allowed one or multiple answers, while five questions required respondents to indicate their level of agreement (Likert scale). The questionnaire was distributed online via the WhatsApp social network and email. A total of 253 respondents participated in the survey, and all 253 questionnaires were completed correctly and in full (Birovčec, 2021). The survey received responses from a total of 253 participants, consisting of 143 females and 110 males. Respondents were categorized into four age groups. The largest age group was 25-35 years, with 95 respondents, while the smallest group was those over 45 years old, with 35 respondents. In terms of education, the majority of respondents held a university degree (137), followed by those with a professional college degree (79), and those with a secondary school degree (37).

Research results

When asked about their preferences about digital banking, the respondents had three options to choose from. The majority of respondents (172, or 68%) prefer to use mobile banking, 49 respondents (19.4%) use both options equally, while the remaining 32 (12.6%) prefer internet banking.

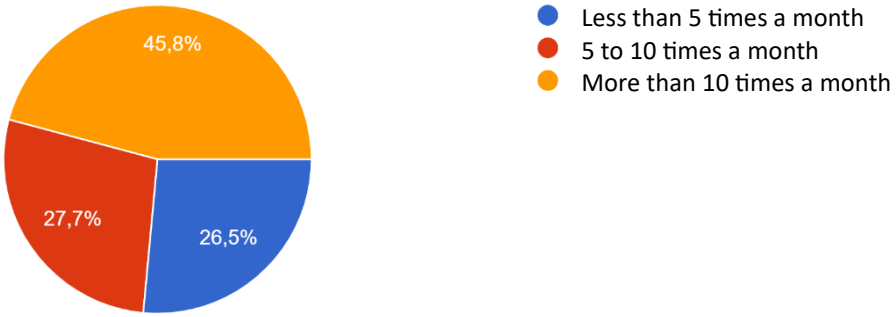
Figure 1: Preferred form of digital banking



Source: authors' treatment of survey results.

The frequency of mobile banking usage was categorized into three levels. The most common response was "more than ten times a month," reported by 116 respondents (45.8%). Additionally, 70 respondents (27.7%) indicated they used mobile banking between five and ten times a month, while 67 respondents (26.5%) reported using it less than five times a month.

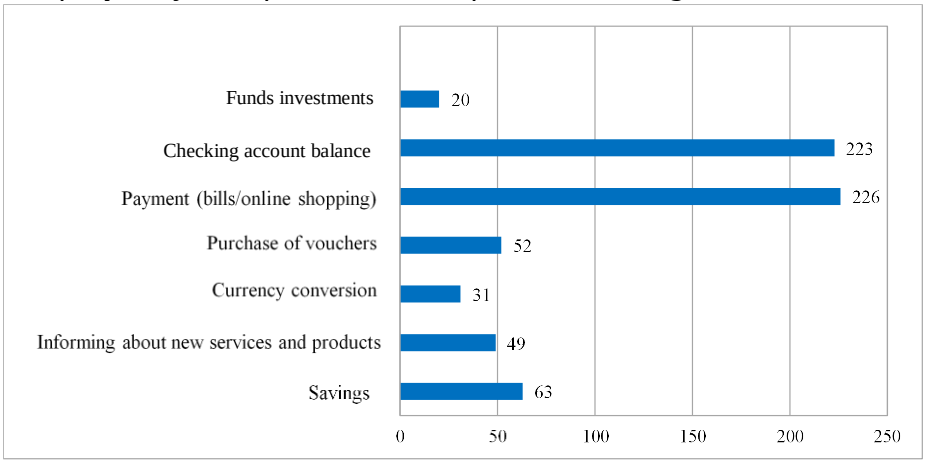
Figure 2: Frequency of use of mobile banking



Source: authors' treatment of survey results.

When inquired about the most frequently used mobile banking services, respondents were given multiple options. The majority primarily used mobile banking for making payments (226 respondents, or 89.3%) and checking account balances (223 respondents, or 88.1%). Additionally, services like buying phone top-ups (52 respondents, or 20.6%) and saving money (63 respondents, or 24.9%) were more commonly utilized compared to internet banking.

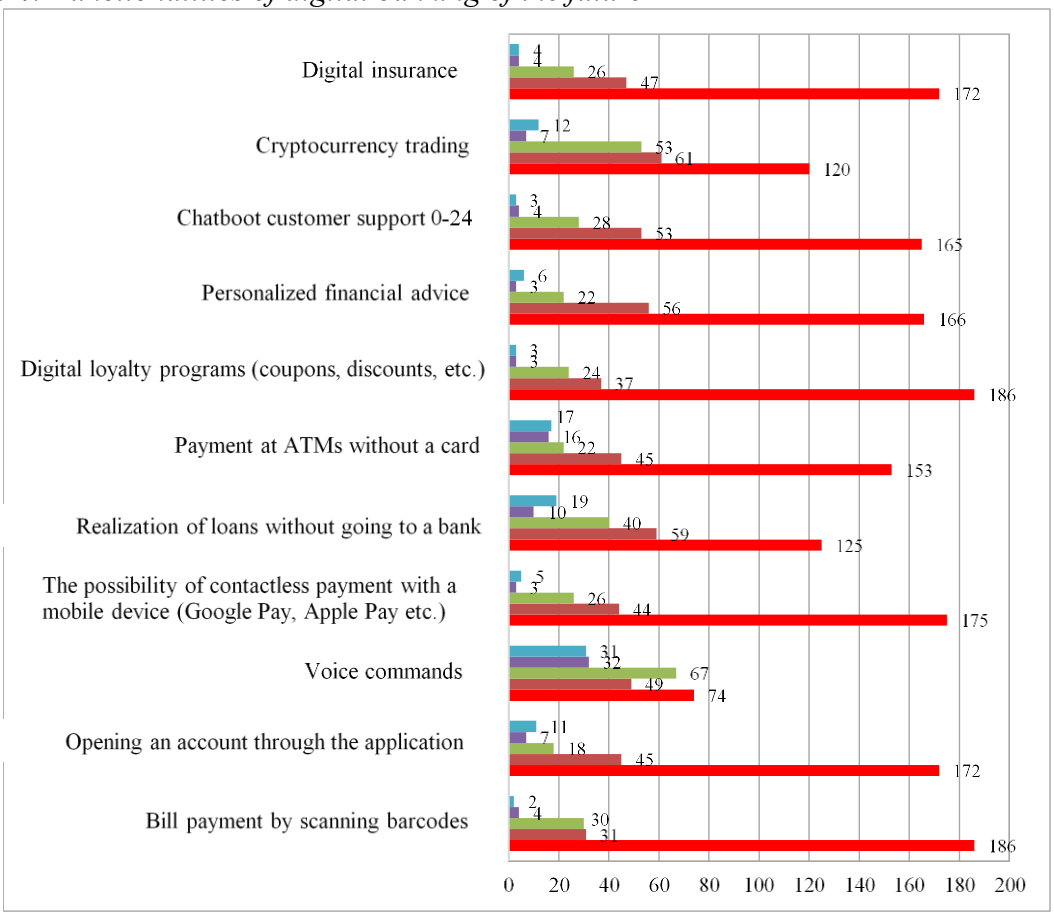
Figure 3: Most frequently used functionalities of mobile banking



Source: authors' treatment of survey results.

Finally, we examined the attitudes of respondents with regard to functionalities of digital banking of the future that banks should implement in their mobile apps. The respondents expressed agreement with all 11 statements, i.e. they believe that digital banking of the future should have all functionalities listed in the individual statements. The greatest disagreement (31 respondents, or 12.3%, expressed partial disagreement and 32, or 12.6%, complete disagreement) was reported for the functionality of voice commands in digital banking of the future (total of 25%).

Figure 4: Functionalities of digital banking of the future



Source: authors' treatment of survey results.

Conclusion, recommendations and research limitations

Digital technologies have permeated nearly every sector of the economy, and the banking sector is no exception. Financial institutions are compelled to leverage digital technologies to gain a competitive edge in an increasingly competitive market. Banks, being key players in the Croatian financial market, are also following this trend. Their mobile apps serve as a clear indicator of their ability to keep pace with global trends in digital business.

Research results show that as many as 68% of respondents prefer using mobile banking to other forms of digital banking. In addition, 89.3% of respondents use mobile banking for making payments and checking account balance. Among other functionalities, the most frequently used are buying phone top-ups and money saving. With regard to functionalities of mobile apps of banks in the future, respondents expressed their desire for various functionalities, the most frequently desired functionality being scanning barcodes or QR codes and receiving discounts and other privileges through a digital loyalty programme.

The conducted research has limitations that should be considered when evaluating its validity, reliability, and the generalization of results. One such limitation arises from using the questionnaire method, which introduces potential bias due to the reliance on respondents' subjective views and opinions.

Future research should concentrate on a more in-depth analysis of how the existing mobile apps of all banks in Croatia are utilized. Additionally, it is recommended that future studies implement surveys in other EU countries and conduct comparative analyses of Croatian banks' use of mobile technologies in relation to banks in other countries. This would highlight how Croatian banks benefit from integrating mobile technologies into their business operations.

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