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Digitalization of Commercial Banks in the Financial Market and the Introduction of Digital Mortgages to Increase Housing Affordability

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ABSTRACT: Digitalization is transforming the global financial sector, creating new formats for banking services and fundamentally changing customer interaction models. In Kazakhstan, where housing affordability remains a persistent challenge, the introduction of digital mortgage products is viewed as one of the key mechanisms for expanding access to housing finance [1]. This paper explores the processes of digitalization in Kazakhstan's commercial banks, with a particular focus on digital mortgages as an instrument for increasing housing affordability. The study relies on national statistics and bank-level data covering 2019–2024, supplemented by case studies of Freedom Bank and Otbasy Bank. A combination of comparative, tabular, and descriptive analysis is applied to evaluate mortgage volumes, interest rates, approval times, and regional disparities [2]. The research also incorporates a literature review of both international and local studies to identify theoretical and empirical gaps. The findings confirm that digital mortgages reduce administrative barriers, accelerate loan approval, and expand financial inclusion by reaching wider population groups. However, affordability constraints remain due to high interest rates, insufficient preferential lending programs, and regulatory challenges. The novelty of this paper lies in linking digital banking innovations to social policy outcomes, highlighting how digital mortgage adoption interacts with issues of housing affordability in an emerging economy. The results contribute to academic debate on digital finance and provide practical recommendations for banks and policymakers. The study concludes that while digitalization can significantly improve efficiency and accessibility, broader institutional and policy measures are essential for sustainable improvements in housing affordability.

Keywords: digitalization; commercial banks; digital mortgage; housing affordability; financial inclusion; electronic verification

I. INTRODUCTION

In the context of rapid technology development and growing competition in the banking sector of the republic, digitalization is becoming an integral part of the strategy of commercial banks. In the Republic of Kazakhstan, as of 2023, about 80% of the population actively uses the Internet, the introduction of digital solutions in banking services is an important step towards improving the efficiency and accessibility of financial products [3]. One of the key problems faced by Kazakhstani society is the affordability of housing. According to the Statistics Agency of the Republic of Kazakhstan, more than 70 % of young people cannot afford to buy their own housing, which underlines the need to create more flexible and affordable mortgage programs. According to forecasts, by 2030, the need for housing in Kazakhstan will grow by 30 %, which sets the task for the state and commercial banks to ensure the availability of mortgage loans. Digital mortgages can greatly simplify the process of obtaining a loan by providing users with the opportunity to apply online, undergo electronic verification and receive loan decisions as soon as possible [4, 5]. In this study, a digital mortgage is defined as a mortgage product in which the application, credit assessment, property valuation, and contract signing are carried out primarily through digital platforms, including integration with government registers and the use of biometric identification and electronic signatures. This not only improves the user experience, but also contributes to the expansion of financial inclusion, allowing a wider range of citizens to access mortgage lending.

The introduction of digital technologies also reduces the time and cost of processing applications, which is important for improving the competitiveness of banks. Moreover, digitalization allows commercial banks to collect and analyze large amounts of customer data, which can lead to more personalized offers and improved customer service. Thus, the relevance of studying the topic of digitalization in the banking sector of Kazakhstan and the introduction of digital mortgages is due to the need to increase housing affordability, adapt to new challenges and technologies, as well as create effective and competitive financial services for the population. The use of modern digital solutions opens up new opportunities to improve the country's financial infrastructure and improve the standard of living of citizens in the country [6]. The conceptual relationship between digitalization and housing affordability can be understood through both finance and social policy perspectives. From a financial standpoint, digitalization reduces transaction costs, accelerates credit approval, and broadens access to mortgage lending, which may improve affordability for certain groups. From a social policy perspective, however, affordability also depends on interest rate subsidies, preferential lending programs, and state regulation. Thus, digital mortgages alone cannot fully resolve the housing affordability problem; their effectiveness is shaped by broader institutional and policy frameworks. In this paper, we integrate insights from Financial Inclusion Theory and social policy studies to conceptualize how digitalization interacts with housing affordability in Kazakhstan.

This paper contributes to the literature by linking digital banking innovations particularly digital mortgage products to the issue of housing affordability in an emerging market context. While prior studies have examined digitalization in banking broadly, few have focused on how mortgage digitalization affects both efficiency and social outcomes. Our research extends this knowledge by providing empirical evidence from Kazakhstan and highlighting the institutional and policy dimensions that shape adoption. The main purpose of this article is to study the processes of digitalization of commercial banks in the Republic of Kazakhstan and the introduction of digital mortgages as a tool to increase housing affordability for the population. Tasks to achieve this goal, the article describes the following tasks:

- To study examples of successful implementation of digital mortgages both in Kazakhstan and abroad.
- To offer recommendations for banks and government agencies on the effective implementation of digital mortgages and improving housing affordability for the population [7].

Research Question: How does the adoption of digital mortgage technologies by commercial banks affect housing affordability in Kazakhstan? Hypothesis: Banks with higher levels of digitalization issue more mortgages with shorter approval times, thereby improving access to housing finance.

II. LITERATURE REVIEW

An analysis of the literature shows a sufficient base of research in the direction of digitalization of commercial banks in the Republic of Kazakhstan, the introduction of digital mortgages to increase housing affordability, in the field of the mortgage market, while it remains relevant to consider the assessment of stock market development on the example of the Russian Federation in the context of new restrictions, taking into account the choice of indicators based on open sources [8]. Thus, the study of this topic is relevant and necessary for the formation of an effective banking system that contributes to improving the living conditions of citizens. Thus, the article examines the impact of digitalization on mortgage lending in Kazakhstan, special attention is paid to the introduction of digital mortgages as a means of increasing housing affordability for the population. Many scientists and experts highlight the advantages and problems associated with digital solutions, which underlines the importance and relevance of this topic for the country's social and economic policy [9].

International research on digitalization in banking has mainly focused on efficiency gains, customer satisfaction, and risk management, with increasing attention to innovations such as blockchain, artificial intelligence, and big data. However, only a few studies directly address digital mortgage systems, and even fewer examine their implications for housing affordability in emerging economies. Local studies in Kazakhstan discuss digital banking and financial technologies more broadly, but they tend to overlook the specific case of digital mortgages and their role in solving social challenges such as housing access. Existing research provides useful descriptive overviews but does not critically assess the institutional barriers, regulatory issues, or socioeconomic impacts of digital mortgage adoption.

This gap in both international and local scholarship motivates the present study. By linking digital banking innovations to the issue of housing affordability, this paper extends prior research and provides empirical evidence from Kazakhstan, offering a more integrated perspective that combines financial and social policy dimensions.

III. MATERIAL AND METHOD

Statistical data analysis data on the distribution of mortgage loans under the “7-20-25” program among second-tier banks in the Republic of Kazakhstan, as well as data on the mortgage market in major cities and regions, were collected and analyzed. The period covered is from January 2019 to December 2023. Sources include official publications of the National Bank of Kazakhstan, government reports, and bank press releases. All data were verified for accuracy and cross-checked across sources.

Comparative analysis a comparison was conducted of the use of artificial intelligence in the activities of financial organizations, average interest rates on loans issued by second-tier banks (STBs) for housing construction and purchase, and the mortgage programs of various commercial banks in Kazakhstan. Sources include official publications, survey results of financial market participants, and verified secondary sources. Tabular analysis data were presented in tables for a clear comparison of indicators, including the number of mortgage loans issued by region, interest rates, and the adoption of digital mortgages. This methodological approach ensures transparency in data collection, the reliability of information, and the validity of the analysis regarding the implementation of digital mortgages and trends in the Kazakhstani market [10].

IV. DATA ANALYSIS

In Kazakhstan, the problem of housing affordability is particularly acute [11]. According to the National Bank of the Republic of Kazakhstan, by 2023, more than 40% of citizens are unable to purchase their own homes due to high prices and difficulties in obtaining mortgage loans. Mortgage lending is one of the main

tools for solving the housing problem (see Figure 1). It allows citizens to purchase housing without the need for a one-time payment of the entire amount, which is becoming increasingly relevant in modern conditions.

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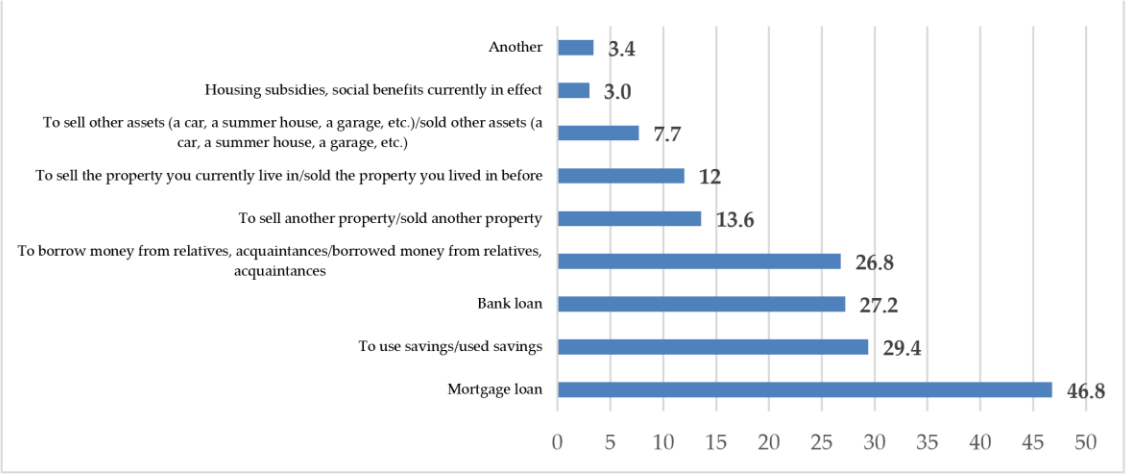

FIGURE 1. Sources of funds for the purchase of new housing, in % [12]

1. THE CURRENT STATE OF MORTGAGE LENDING

The main source for buying a home has become a mortgage. Despite the fact that the majority of both those who bought (18.5%) and those planning to buy (26.9%) are aimed at expanding their living space, the share of those who indicate that they sold their previous housing is not so great – 12.8%. However, among those who plan, this figure is more than twice as high – 27.8%. This may be due to the rise in house prices in the last three years [13]. Freedom Finance Global[i] research data shows that slightly more than half of Kazakhstanis (52.2%) are homeowners [14]. Among the youth, only 29.7% of owners were identified, and in the older group there are already 75.5%. In the most economically active group (30 years – 44 years), which accounts for the majority of purchase and sale transactions and mortgages, only 45.8% are owners. At the same time, there are no statistically significant differences between the number of homeowners by place of residence (in cities – 50.7%, in villages – 54.5%), the level of material well–being (low income – 52.2 %, average – 53.2%, the highest - 60.0 %) (see Figure 2).

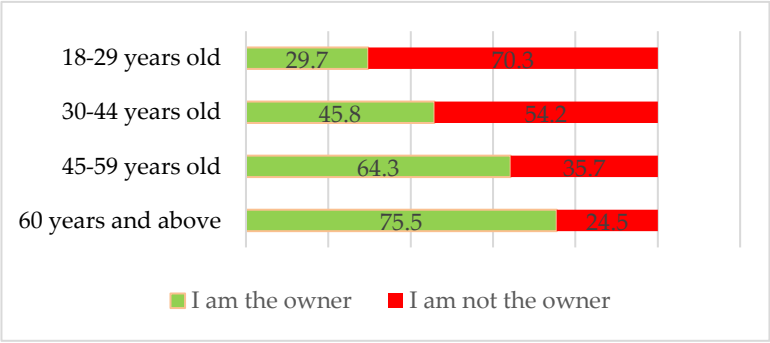

FIGURE 2. The availability of housing in the property, depending on the age, % [ii]

Among all the surveyed Kazakhstanis, only 9.3 % report that they own additional housing that they can rent [15]. Nevertheless, slightly less than half of them (45.6 %) do so. The younger the owner of the additional housing, the more often he rents it out, which, apparently, is associated with less encumbrance in providing housing for the younger generation of relatives [16]. The remainder includes 4.2 % of Kazakhstanis who are

active in the rental market. But it should be borne in mind that 47.8% of people are not homeowners, and the number of people renting it is about 17%, which is a percentage more than renting. According to the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan, in 2023 the volume of mortgage lending increased by 15 % compared to the previous year, which indicates a growing interest in this tool among the population [17].

In this context, the relevance of the introduction of digital mortgages becomes obvious: it can significantly simplify the process of obtaining a loan and reduce barriers for borrowers [18]. Digitalization in the banking sector is a process of integrating modern information technologies into banking services and operations, which significantly changes traditional approaches to customer service and resource management. The introduction of digital technologies, such as online banking, mobile applications, automation and data processing systems, allows banks to increase the efficiency of their activities, optimize costs and improve customer interaction. In particular, digitalization helps to simplify and speed up the processes related to lending. For example, automating the analysis of borrowers' creditworthiness can significantly reduce the time required for loan approval. This is especially important in the context of growing competition in the financial services market, where speed and quality of service are becoming key success factors [19]. Thus, the role of digitalization in mortgage lending is undeniable. It not only helps to improve the quality of customer service, but also solves the current problems of housing affordability in Kazakhstan. In the context of the growing need for affordable housing and the complexity of traditional methods of obtaining a mortgage, the introduction of digital solutions is becoming an integral part of the development of the banking sector and the economy of the country as a whole [20].

2. ANALYSIS OF CREDITING BY COMMERCIAL BANKS

Let's analyze mortgage lending in the Republic of Kazakhstan As of July 1, 2024, the total mortgage portfolio of the Republic of Kazakhstan amounted to 5,582 billion tenge, including: - mortgage portfolio of STB 5,535 billion tenge (including the loan portfolio of Otbasy Bank JSC 3,200 billion tenge or 57.8%); portfolio of mortgage housing loans of mortgage organizations 47 billion tenge The volume of the total mortgage portfolio of the Republic of Kazakhstan is shown in Figure 3 [21].

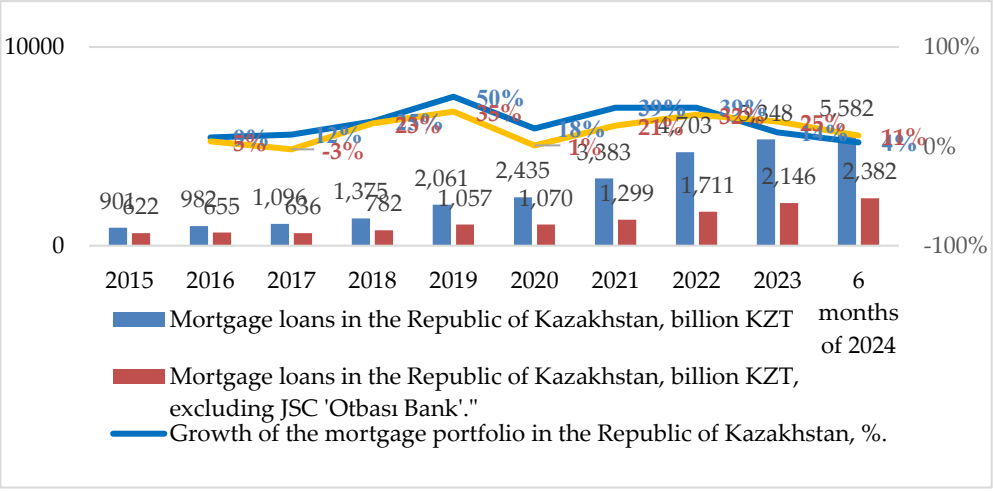

FIGURE 3. The volume of the total mortgage portfolio of the Republic of Kazakhstan.[iii]

The total mortgage portfolio of the Republic of Kazakhstan increased by 4 % compared to 2023. The growth of the STB mortgage portfolio also amounted to 4 % (2023 – 5,297 billion tenge), the portfolio of mortgage organizations decreased by 9 % compared to 2023 (51 billion tenge). Mortgage portfolio of the Republic of Kazakhstan in % of GDP (see Figure 4). This figure illustrates the trend of the mortgage portfolio as a share of GDP, showing gradual growth over recent years. It highlights the increasing role of mortgage

lending in Kazakhstan's financial system and indicates potential for further expansion through digital mortgage initiatives.

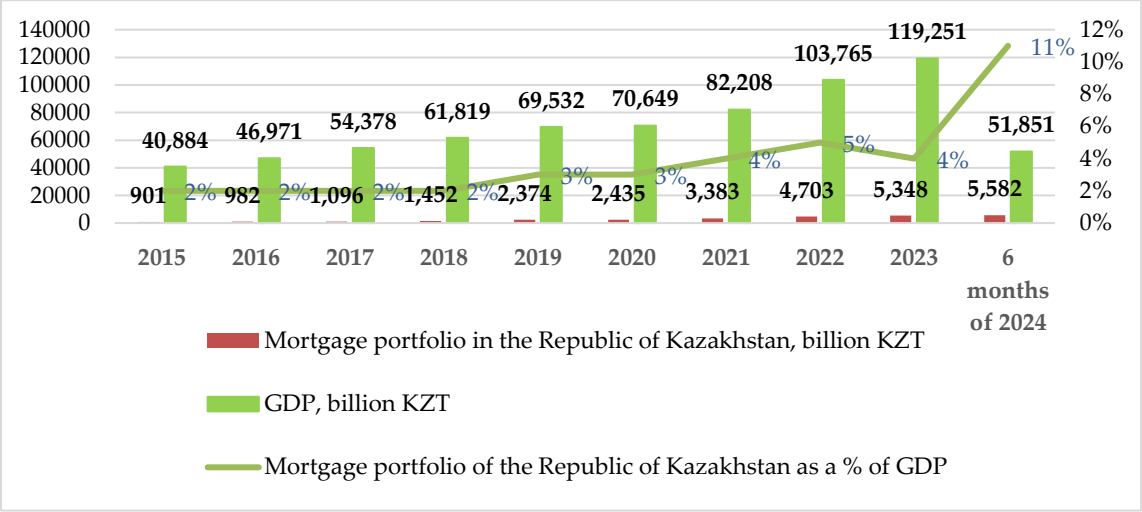

FIGURE 4. Mortgage portfolio of the Republic of Kazakhstan in % of (GDP) [22].

The share of the mortgage portfolio in the country's GDP in the first half of 2024 amounted to 11%. In the estimated parameter of mortgage volumes to GDP in 2022 (3.5%), our country was close to Lesotho (3.86%), Guatemala (3.41%) and Papua New Guinea (3.27 %). Figure 5 compares Kazakhstan with other countries, showing that despite growth, the mortgage-to-GDP ratio remains relatively low. This indicates room for expansion, especially through digital mortgage platforms, which can improve accessibility and efficiency in lending.

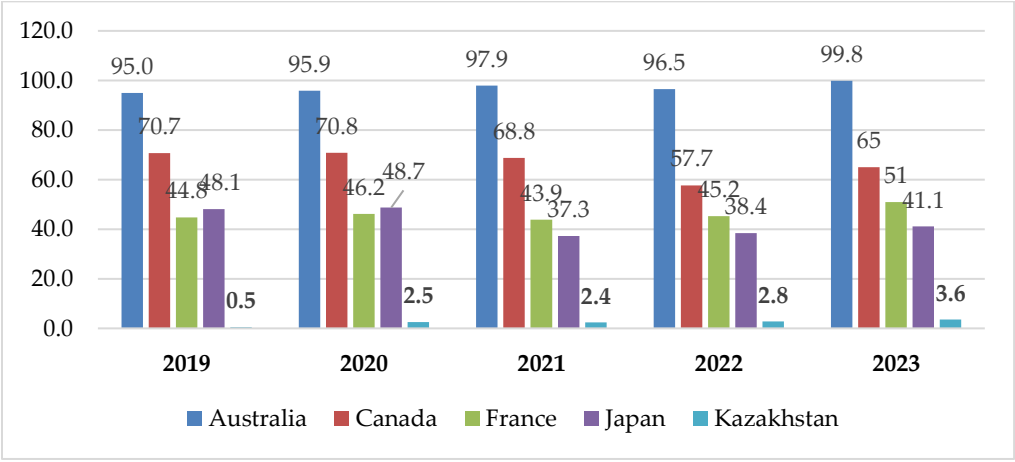

FIGURE 5. The ratio of mortgage volumes to GDP, %.

In comparison with other countries, the Republic of Kazakhstan occupies a small share of the volume of mortgage loans to GDP [23]. Digital mortgage is the use of technology to simplify and automate the processes of obtaining a mortgage loan. This approach is actively used in different countries, which allows to reduce the processing time, increase the transparency of transactions and reduce costs for both customers

and commercial banks themselves. We will conduct a comparative analysis of the application of digitalization in foreign countries (see Table 1).

Table 1. Comparative table of foreign experience.

A country	Platforms	The application process	Credit analysis	Available tools	Features
USA	Quicken Loans, Better.com	Completely Online	Automated	Preliminary assessment, calculators	Quick approval, minimization of paperwork
Great Britain	Habito, Highway	Completely Online	Automated	Comparison of offers, consultations	Mortgage selection services
Germany	Smava Baufi24	Completely Online	Automated	Blockchain for Transparency	The use of LED technology
Australia	Landy, uno	Online with the running process	Automated	Personalized recommendations	High degree of automation
Canada	Ratehub, mortgage alliance	Online, the possibility of comparison	Automated	Calculators, calculation tools	a wide range of mortgage offers

Source: based on the studied online materials, developed by the authors

Digital mortgages help and speed up the process of obtaining a home loan [24]. Each country has its own unique approaches and platforms, but the common features are automation processes, the use of technology to improve the efficiency of business processes. The growth in the issuance of mortgage loans by commercial banks is growing rapidly. Let's consider the dynamics of mortgage portfolio growth by second-tier banks in the Republic of Kazakhstan (see Figure 6).

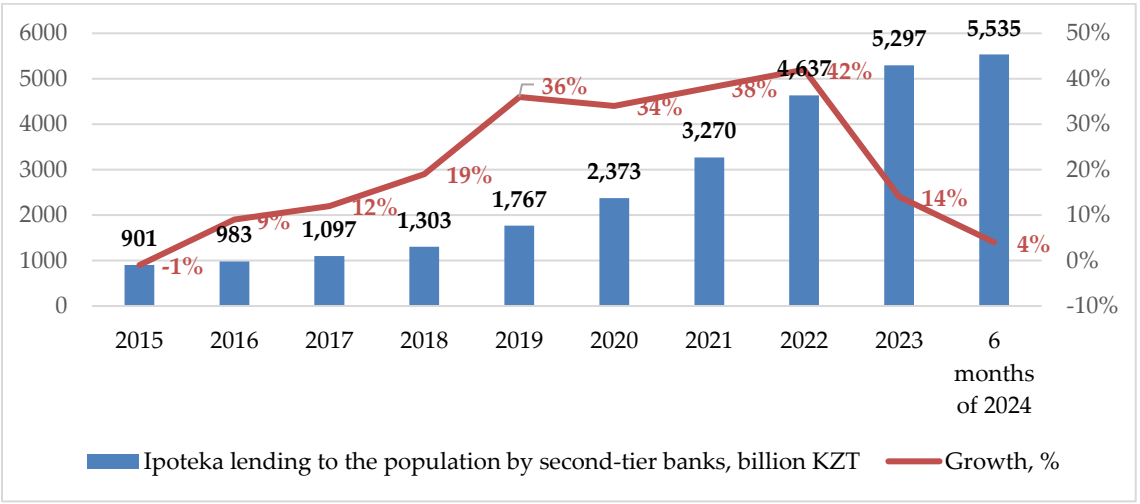

FIGURE 6. Dynamics of mortgage portfolio growth by second-tier banks in the republic of Kazakhstan.

3. FEATURES OF THE HOUSING MARKET IN THE REGIONS OF THE COUNTRY

The issuance of mortgage loans differs by region, which is due to the territorial characteristics of the housing market in the region.

Table 2. Mortgage loans by region.

Region	2023		8 months of 2024		Δ
	billion tenge	fraction	billion tenge	fraction	
Total for the Republic of Kazakhstan	5 297	100%	5 535	100%	+4%
Abai	92	2%	97	2%	+5%
Akmola	150	3%	153	3%	+2%
Aktobe	229	4%	233	4%	+2%
Almaty	102	2%	101	2%	-1%
Atyrau	136	3%	138	2%	+1%
East Kazakhstan	176	3%	181	3%	+3%
Zhambylskaya	116	2%	117	2%	+1%
Zhetysu	24	0%	37	1%	+53%
West Kazakhstan	143	3%	148	3%	+3%
Karaganda	421	8%	362	7%	-14%
Kostanay	159	3%	164	3%	+3%
Kyzylorda	74	1%	75	1%	+1%
Mangystau	161	3%	161	3%	-
Pavlodar	162	3%	168	3%	+3%
North Kazakhstan	76	1%	75	1%	-1%
Turkestan	43	1%	51	1%	+18%
Ulytau	6	0%	7	0%	+24%
Almaty city	1 188	22%	1 322	24%	+11%
Astana city	1 563	30%	1 644	30%	+5%
Shymkent city	276	5%	301	5%	+9%

An analysis by region shows that Astana and Almaty account for 54% of the total mortgage portfolio of STB. In the first half of 2024, mortgage loans in the amount of 803 billion tenge were issued to the population. In February 2024, the largest number of mortgage loans issued was recorded – by 158 billion tenge [25]. While Table 2 provides descriptive evidence of regional variations, the current analysis remains preliminary. To strengthen the findings, significance testing (such as, t-tests, ANOVA) and econometric methods (such as regression models using income levels, housing supply, and digital infrastructure as predictors) could be applied in future research. This would allow us to verify whether the observed differences are statistically significant and to identify the main factors driving regional disparities in mortgage lending.

The average monthly volume of mortgage loans issued in the first half of 2024 amounted to 133.8 billion tenge, which is 13% higher than the average monthly volume of mortgage loans issued in the first half of 2023 (118.2 billion tenge). Sentiment among potential home buyers is mainly dictated by purchasing power [26].

90 % agree with the need to purchase housing. The largest part (33.9 %) reports that the preferred option would be to resolve the purchase issue this year. A slightly smaller number of people 31.6 % are ready to buy a house within three years. At the same time, the age of the majority of those who want to buy a house this year is 25 years – 34 years (37.7 %). This part of the population is economically active, but is inferior in purchasing power to people 35-55 years old. Among those planning to buy a house, the largest part chooses

new, but already commissioned houses, refusing to purchase housing in a house under construction [27]. The trend varies depending on age: young people aged 18-24 in 60% of cases choose houses in commissioned new buildings, however, with age, the preference for secondary housing increases up to 41%. It occurs in people 35-55 years old. Of course, the interest rate in commercial banks plays an important role in the amount of loans issued. The average interest rate on loans issued to STB for the construction and purchase of housing for citizens from 2015-2024, %, has constantly varied (Figure 7) [28].

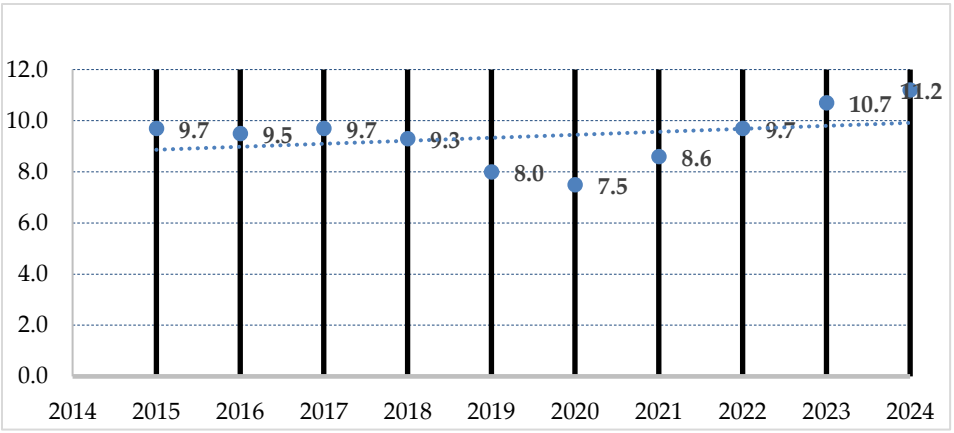

FIGURE 7. The average interest rate on loans issued to citizens for the construction and purchase of housing.

Since 2018, there has been a downward trend in the average remuneration rate. However, since 2021, the rate has increased by 2.6 percentage points to 11.2% as of June 2024 [29]. The rate increase is due to a decrease in the volume of loans issued under preferential market mortgage programs on the market. Mortgage loans in the country's market are offered by 8 STBs, 7 of which participate in the implementation of the 7-20-25 program. Preferential mortgage programs involve lower interest rates – from 5% – and compliance with additional conditions. Among them are belonging to the categories of citizens for whom quotas are assumed (young families, women, large and low–income families, persons with disabilities), the choice of real estate objects among those offered by the bank and others. Now, of the known nine preferential programs, some have already been suspended ("Nurly Zher", "Shanyrak" and others). At the same time, the remaining ones have a narrowly focused characteristic for persons of a certain social nature and the place of housing to be purchased (civil servants, youth under 35, socially unprotected part of the population, military personnel, etc.) [30]. A separate place in the market is occupied by Otbasy Bank, which issues both preferential mortgages with reduced interest rates and loans of a mixed nature in the absence of sufficient valuation the bank's indicator through an "interim loan"[31]. Apart from the offer of Otbasy Bank JSC, the most attractive rate on the market is at Altyn Bank JSC from 14 %. Next are JSC "Halyk Bank"[iv], JSC "Forte Bank" and JSC "Bank Center Credit" with a rate of 17.5 %. Let's conduct a comparative analysis of commercial banks (Table 3).

Table 3. Comparative analysis of commercial banks

№	Name of the bank	The term of the mortgage, months.	Initial payment%	The interest rate	Max. loan amount	«7-20-25»
1	JSC "Halyk Bank"	up to 240	from 0 to 20%	from 17.5%	depending on the Applicant's ability to pay	+

2	Forte Bank JSC	up to 240	From 15%	from 17.5%	from 500 thousand tenge to 200 million tenge Astana, Almaty, Shymkent, Karaganda, Aktau, Atyrau, Aktobe, Ust-Kamenogorsk – 40 million tenge, for other regions – 25 million tenge; there are no restrictions on the initial payment of 30%.	+
3	JSC "Bank Center Credit"	up to 180	from 20%	from 17.5%		+
4	RBK Bank JSC	up to 180	from 30%	from 20,5%	up to 75 million tenge	+
5	Nurbank JSC	up to 240	from 30%	from 19,5%	50 million tenge (it is possible to receive a larger amount on individual terms)	-
6	JSC "Bank Freedom Finance Kazakhstan"*	up to 240	from 20%	from 17,2%	up to 70 million tenge.	+
7	JSC "Altyn Bank"	up to 240	from 20%	from 14%	up to 175 million tenge.	+

Source: Digital mortgage.

As of June 27, 2024, the volume of loans issued to STB within the framework of the 7-20-25 program amounted to 74.6 thousand by 1.023 trillion tenge [32]. Three cities are in the lead among the regions (Figure 8).

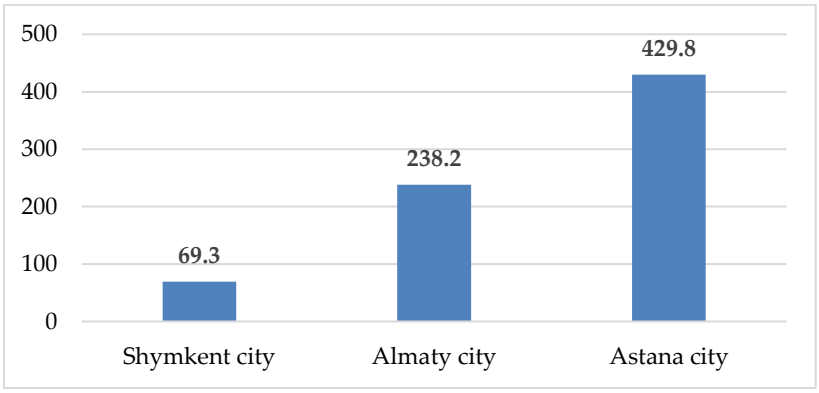

FIGURE 8. Leading cities among the regions.

Within the framework of the 7-20-25 program, a significant expansion of mortgage lending is expected due to the measures of the National Bank of Kazakhstan and the implementation of the roadmap [33]. It is predicted that the total mortgage portfolio of banks will grow by 1.6 trillion tenge by 2030, which will improve the living conditions of about 100,000 families [34]. These measures will not only increase housing affordability, but also have a positive impact on the economy, contributing to the growth of the construction sector and related industries [35]. Distribution of loans by 7-20-25 to second-tier banks in Kazakhstan (figure 9) [36].

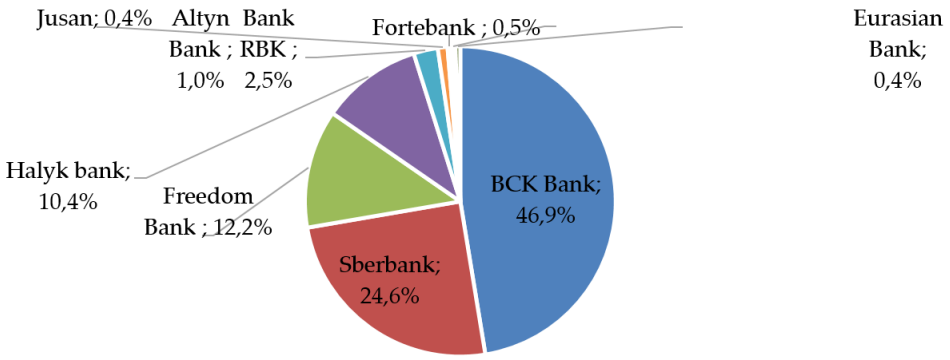

FIGURE 9. Distribution of loans by 7-20-25 to second-tier banks in Kazakhstan[v].

Of all the participating banks, Freedom Bank, which joined the program only at the beginning of 2022, demonstrates the most active growth in the number of loans issued in recent months, which is confirmed by official information from KFU, and is also a leader in the field of digital mortgages [37].

Freedom Bank began issuing mortgages in March 2022, starting with a 30% share of the market. Before the introduction of the limit, it reached 63% among all STBs who participated in the issuance of loans under the state program [38]. The advance of the market in terms of loans issued occurred in June, then the bank significantly strengthened its position in the 4th quarter, issuing an average of 63 % more than other banks in this period. The popularity of obtaining a preferential loan through Freedom Bank JSC was in the digitization of mortgages [39]. This made it possible to apply for a mortgage loan online, without collecting documents and going to the PSC. A significant advantage is the fact that the whole process takes an average of 24 hours. Against the background of a drop in the dynamics of the implementation of applications in most banks under the 7-20-25 program, Freedom Bank's activity in 2022 led to a monthly record increase in indicators starting in March this year and has identified the program [40].

V. DISCUSSION

- Advantages of a digital mortgage

Digital mortgages have a number of advantages over traditional ones; however, financial institutions have been able to realize these advantages relatively recently. Firstly, a digital mortgage, like all digital products, allows you to make a purchase without leaving the digital environment, that is, quickly and contactless [41]. These properties became especially important during the coronavirus pandemic, when physical contact was limited. In order to make contactless large transactions secure, the government and financial institutions had to work on digitalizing their internal processes and documents, as well as on cybersecurity. Digital mortgage optimizes the process as much as possible and deprives it of a corrupt component: the range of required documents and the deadline for inspections are limited [42]. The desire of banks to guide the client through the funnel from lead generation to sale as quickly as possible forces them to reduce the number of documents and the duration of procedures as much as possible, while the bank is forced to improve internal processes such as scoring and so on [43]. There is competition between banks: who will issue more mortgages and in a shorter period of time from the receipt of the application to the approval of the loan [44]. Last year, it was reported that Kazakhstan (the indicators of the pioneer of the Freedom Bank direction were measured) took the leading place among 11 countries where financial institutions offer digital mortgages, and the level of digitalization of the processes of the model bank of Kazakhstan turned out to be significantly higher than that of the runner–up Molo Finance (Great Britain) - 90 against 55 % [45].

The rapid growth of mortgage loans in the bank is explained by the simplicity and convenience of the process due to its complete digitization [46]. "Kazakhstanis no longer need to spend time going to PSC and

banks to collect documents. Digitalization allows people to buy apartments online, 24/7, without reference to location. The unconditional advantages of a digital mortgage can also include the time to receive the service – 24 hours from the moment of application to the issuance of a loan [47]. The decision to issue a loan is made not by an employee, but by a system that analyzes hundreds of client parameters, which eliminates the human factor. The use of artificial intelligence is a key enabler of digital mortgages. AI supports borrower scoring, online collateral assessment, and real-time decision-making, allowing banks to issue loans faster and more securely. This demonstrates that AI adoption is directly connected to the efficiency and accessibility of mortgage services, rather than being a separate topic.

However, despite the convenience and progressiveness of the product, at the beginning of November 2022, only a few of the 21 Kazakhstan banks offered digital mortgage [48]. The reason is the small volumes of market mortgages. Almost the entire volume of mortgage demand is taken away by preferential government programs [49]. And since digital technologies require investments in support and development, most banks are not interested in spending money in a narrow market. Meanwhile, commercial mortgages, even with limited client resources, are important for the banking portfolio. It strengthens the bank with "long-term" customers who can be offered other products, and also helps to collect a personal database of their behavioral data [50].

Freedom Bank was one of the first to announce the development of digital mortgages, launching it in July 2021 [51]. The bank's press service explained that this step was caused by the desire to "provide Kazakhstanis with convenient, fast and easy-to-obtain digital financial products and services." Before the launch of digital mortgages, it took an average of three to four weeks to get a mortgage loan on the market. Freedom Bank has digitized this complex retail product and reduced the loan issuance time to a day. The bank offers its own digital product (a mortgage for secondary housing with a down payment of 30%), and also participates in the state program "7-20-25", providing online loans for the primary housing market. According to the press service, since the beginning of 2022 (by mid-October), a total of 125.1 billion tenge has been issued for two products, of which 109.7 billion tenge accounted for the 7-20-25 direction, and 15.4 billion tenge for secondary housing [52]. Digital mortgages account for 72% of Freedom Bank's total loan portfolio. One of the tools of digitalization in commercial banks is blockchain, a distributed data storage technology that guarantees their reliability and security. In traditional information systems using the client-server model, data is stored in highly secure and centralized databases [53]. Today, such databases are used by governments, banks, insurance companies and other organizations. Centralized databases are controlled by their owners, including update management, access and protection from cyber threats. The National Bank of Kazakhstan conducted a survey of market participants. In order to identify the readiness of the financial market of Kazakhstan to use the potential of artificial intelligence technology, a survey was conducted. 94 participants of the financial market took part in it. These are second-tier banks, MFIs, insurance organizations, securities market participants and residents of the AIFC [54].

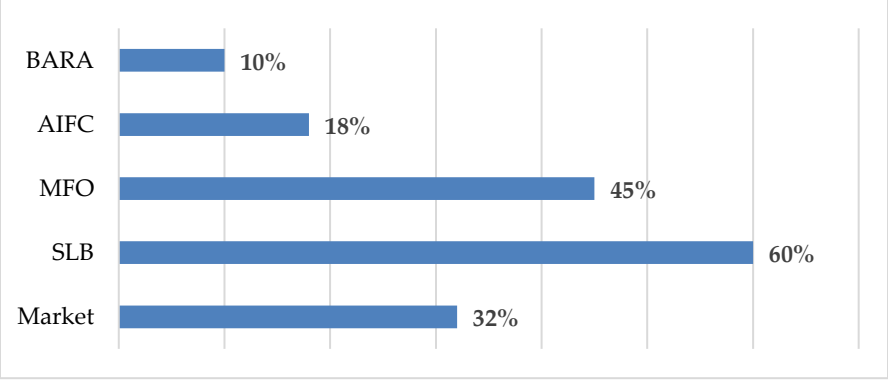

FIGURE 10. The use of AI in the activities of financial organizations [55].

According to the survey results, currently 31% of financial market participants use AI in their activities to some extent. The maximum level of AI use is noted among STBs – 60%. At the same time, 45% of respondents noted that they plan to use AI in 2024 (Figure 10).

As the survey results showed, the development of AI in 2024 is directly related to the current level of use of this technology. This may indicate that initial investments and experience in implementing AI strengthen organizations' intentions to continue investing in this technology. Recall that Kazakhstan is among the top three countries in the region in the global innovation index. In the IMD World Digital Competitiveness Ranking (2023), which measures the ability and willingness to implement and use digital technologies, Kazakhstan ranked 34th among 64 countries in the world.

In 2024, it is planned to actively develop and adapt suitable strategies for regulating and stimulating the development of AI. In online lending, the main indicator for the borrower is the speed of receiving money, and for the bank the correct mechanism for assessing the risks of issuing funds. Freedom Bank has developed its own borrower scoring system and online collateral assessment. Through integration with government services, the bank obtains data from databases to which it has access with the consent of the client through his biometric identification. The Bank has also resolved the issue of online registration of real estate transactions. Online real estate valuation is based on Data Science tools, the bank's own development. It also has a number of integrations with various services, which allows you to make decisions in a few seconds. When evaluating real estate, not only the declared apartment is taken into account and evaluated, but also all real estate objects according to similar parameters, first in a certain residential complex, then in a given area, then in the city. Thus, possible deviations depending on the dynamics of price changes in the market are leveled. The bank's digital service will also provide a notary who will prepare the documents for signature. The borrower signs the documents using an EDS, which can be obtained online during the loan paperwork process.

The flagship of mortgage lending, the state–owned Otbasy Bank, is also developing a digital format, but from the point of view of automation, it is more correct to call it an online mortgage. If Freedom Bank has completely digitized the loan process, then Otbasy bank has left room for interaction with its employee by offering a concierge mortgage. The application and assessment of the client's solvency take place online; however, the client is remotely accompanied by the bank's manager throughout the entire process of obtaining a loan. The client independently searches for real estate and evaluates it. When it is ready, the video manager helps to make a loan application and informs the client about its status. If the bank issues a positive decision, the operator helps to book a convenient time with a notary to conclude a purchase and sale transaction. The client's physical presence is already required there.

After that, the borrower appears at the bank's branch for the first time to submit documents, sign a loan agreement and a repayment schedule. Meanwhile, the bank offers another online mortgage option if the borrower's income is insufficient, co–borrowers can connect to the video call, even if they are located in another city or country. The borrower's scoring in Otbasy Bank does not differ much from similar ones on the market. Information systems automatically analyze the client's data according to the set parameters his creditworthiness, behavioral and qualitative characteristics. The bank's system also automatically analyzes loan data (loan term, interest rate, amount of savings on deposit), comparing it with the borrower's capabilities.

In the first nine months of 2022, 26.1 billion tenge was issued in the online mortgage format. It occupies 3% of the bank's loan portfolio. Digital mortgages are becoming the new standard for the market. Today, Freedom's share in the commercial mortgage market of STB is about 45%, not counting the bank's deposits. It should be clarified here that for most borrowers, the lending rate is of paramount importance. Such persons mostly become clients of Otbasy Bank, receiving subsidies from the state when accumulating funds, and then on a loan. However, state programs are designed for specific social categories of citizens and cannot offer anything to those who do not fit into this framework. A market mortgage implies higher rates, but it gives a bonus in the form of a faster real estate purchase process. A digital mortgage for secondary housing is a market product with an interest rate of 17.6% per annum.

During the year, 1,218 loans worth KZT 15.4 billion were issued in 17 cities of Kazakhstan with an average interest rate of 17.9% per annum. The number of requests for the current year alone amounted to more than

40 thousand," according to Freedom Bank. They note the growth in popularity of the product and the positive dynamics of issues with little volatility at the beginning of the year. The main drivers are online registration, online real estate valuation, the speed of consideration and issuance of a loan, the absence of the need to collect documents, go to a PSC and a bank branch. "The whole process takes no more than a day. This is an absolute record not only in Kazakhstan, but all over the world.

While digital mortgages offer significant convenience, policymakers and banks should address associated risks. Cybersecurity measures must be strengthened to protect client data and digital transactions. Additionally, older populations and digitally inexperienced users may face financial exclusion; targeted support programs, user education, and hybrid service formats (online + offline) can help mitigate this risk. Governments and banks should develop cybersecurity standards for digital mortgage platforms, implement educational initiatives for less tech-savvy users, and conduct regular audits and stress tests to ensure system reliability, security, and inclusiveness. In comparison to other emerging economies, Kazakhstan's adoption of digital mortgages demonstrates both progress and certain limitations. For instance, in Russia, several banks have launched digital mortgage platforms, but the penetration rate remains lower than in Kazakhstan due to the larger size of the market and regional disparities in internet accessibility. Similarly, Uzbekistan has begun experimenting with online mortgage services, but regulatory and technological constraints slow down widespread implementation. These comparisons highlight Kazakhstan's relative leadership in digital mortgage adoption among neighboring emerging markets. The integration of advanced scoring systems, online property evaluations, and collaboration with developers positions Kazakhstani banks ahead in terms of efficiency and user convenience. At the same time, lessons from other countries suggest that regulatory support and public awareness campaigns could further accelerate adoption and improve financial inclusion.

Recently, the cooperation of banks with developers has been gaining momentum. Such interaction gives the borrower the opportunity to purchase an apartment from a construction company in an online format. The process involves choosing an apartment on the developer's website followed by online verification of the borrower by the bank. The latter's marketplaces accumulate mortgage offers and gradually replace visits to different STB sites for customers. At the same time, we can probably expect a concentration of offers from smaller developers on the websites of banks. We will conduct a SWOT analysis of the mortgage market in Kazakhstan (Table 4). In order to provide an evidence-based assessment of the mortgage market, a SWOT analysis was conducted using statistical data from the National Bank of Kazakhstan, reports of commercial banks, and government housing programs (2022–2024). The analysis reflects both quantitative indicators (mortgage portfolio dynamics, interest rates, loan distribution by region) and qualitative factors (housing demand, regulatory framework).

Table 4. SWOT analysis of the mortgage market in Kazakhstan.

Strengths	**Weaknesses**
Urbanization and demographic growth (urban population +1.8% annually, 2020–2023 [	Excessive interest rates on commercial mortgages (average 17.6% per annum in 2023
Stable demand for secondary housing (≈60% of total transactions in 2023)	Low creditworthiness of a significant share of the population (debt burden ratio above 40% for 25% of borrowers
Constant demand from the population (90% of surveyed citizens expressed need for housing)	Ban on construction of residential complexes without schools/kindergartens, which limits supply
Opportunities	**Threats**
Government support programs such as “7-20-25” (loan portfolio: 109.7 bln tenge in 2022)	Low purchasing power: real incomes grew only 1.2% in 2023
Introduction of new preferential lending programs (e.g., Otbasy Bank concierge mortgage)	Currency volatility (tenge depreciated by 10% against USD in 2023
Downward trend in base rate (from 16.75% in late 2023 to 15.25% in 2024	Low-quality construction of certain residential complexes, reducing long-term trust

Growing cooperation between banks and developers, enabling online purchase formats	Overload of bank back-office processes due to rising demand [56]

The presented SWOT analysis is not only descriptive but also supported by statistical indicators and market cases, which increases its analytical validity. This approach allows to more accurately assess the current state and prospects of the mortgage market in Kazakhstan. Overall, the mortgage market demonstrates a set of strengths and weaknesses, as well as threats and opportunities for further development. In addition, the robustness of digital mortgage development should be considered under possible macroeconomic shocks. For instance, a sharp increase in the base rate, exchange rate volatility, or a slowdown in real income growth could significantly reduce the affordability of market mortgages, even in digital format. Sensitivity analysis to such shocks would allow a more comprehensive assessment of the long-term stability of the mortgage sector and would increase the rigor of the study.

This is possible due to the integration of the developer's platform and the STB information systems. Of the major developers, Bazis-A and BI Group are already working with online banks. So, the BI Group marketplace offers a calculation calculator for mortgage loan offers from five STB and a virtual viewing of apartments in the company's residential complex. Thus, the process of choosing a home and applying for a mortgage is greatly simplified, which is beneficial for both the client, the bank, and the developer.

VI. CONCLUSION

The mortgage market in Kazakhstan is undergoing significant changes reflecting both internal and external factors. Despite this, initiatives such as the 7-20-25 programs monitor housing affordability for certain social groups, and also convey to you the challenges associated with maintaining the activity of a competitor in the market. Digitalization of mortgage lending processes opens up new horizons for customers, providing quick and convenient access to loans. Bank Freedom began to implement digital mortgage loans, greatly simplifying the process of obtaining loans and reducing time costs for customers. This not only facilitates the consideration of mortgage loans, but also generates new standards of service quality. Effective government policy should focus on lowering interest rates and raising household incomes, which, in turn, will improve consumer demand. In addition, it is important to pay attention to the problem of the stability of the mortgage market to external economic shocks. Global changes, such as fluctuations in oil prices and geopolitical risks, can have consequences for the global climate and, consequently, for mortgage lending. Therefore, it is important to develop strategies aimed at minimizing these risks.

The development of the stock market and increased competition between banks can also lead to a decrease in the cost of mortgage loans and an improvement in the quality of services. Optimization of government support for developers, for example, through the provision of land and employment, creates conditions for the development of the affordable housing market and increases investment attractiveness in the construction sector.

This study contributes to the literature by demonstrating how digital banking innovations, particularly digital mortgages, intersect with issues of housing affordability in an emerging economy. By integrating insights from financial inclusion theory and social policy, the research advances a more comprehensive conceptual framework for analyzing digital finance. Future research could expand on these findings by conducting cross-country comparisons, applying econometric modeling to measure long-term effects, and examining risks such as cybersecurity and financial exclusion among vulnerable groups. In conclusion, we can say that the mortgage market of Kazakhstan is at an important stage of its development. The competent integration of modern technologies, close attention to the needs of various groups of the population and strategic planning on the part of the state are key factors for ensuring growth and providing housing for all citizens. Only through joint efforts can significant results be achieved and stable mortgage development be ensured. Practical recommendations for banks and government authorities:

1. FOR COMMERCIAL BANKS

- Implement digital mortgage platforms with a full customer service cycle: online application, property appraisal, scoring, and document signing. Example: Freedom Bank's experience, where loan approval time was reduced from 3–4 weeks to 1 day.
- Develop in-house scoring systems and online property valuation tools using Data Science, integrated with government databases to accelerate decision-making processes.
- Actively collaborate with developers by creating online marketplaces for real estate purchases, simplifying property selection and mortgage processing for clients.

2. FOR GOVERNMENT AUTHORITIES AND REGULATORS

- Continue supporting affordable housing programs, such as the "7-20-25" program, and consider expanding their coverage to a wider range of citizens.
- Promote the digitalization of the mortgage market, including the development of standards for online document signing and integration with government services.
- Ensure the stability of the mortgage market amid external economic shocks through macroprudential measures and interest rate monitoring.

3. GENERAL MARKET RECOMMENDATIONS

- Focus on transparency and speed of mortgage services: clients value minimal personal interaction and quick loan approval processes.
- Utilize accumulated customer behavioral data to personalize offers and develop new products.

Practical recommendations for the development of Kazakhstan's mortgage market aim to increase accessibility and efficiency of digital mortgage products. Banks should implement targeted digital solutions, simplify application procedures, enhance integration with government services, and use Data Science and AI tools for risk assessment. Government policy should focus on lowering interest rates, supporting developers, and increasing household incomes. Implementing these measures will accelerate market growth, make mortgages more accessible to a broader population, and create a sustainable environment for the development of financial and construction sectors.

4. RISK CONSIDERATIONS

While digital mortgages offer significant convenience, policymakers and banks should address associated risks. Cybersecurity measures must be strengthened to protect client data and digital transactions. Additionally, older populations and digitally inexperienced users may face financial exclusion; targeted support programs, user education, and hybrid service formats (online + offline) can help mitigate this risk. Governments and banks should develop cybersecurity standards for digital mortgage platforms, implement educational initiatives for less tech-savvy users, and conduct regular audits and stress tests to ensure system reliability, security, and inclusiveness.

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