Ministry of Education and Science of the Republic of Kazakhstan
Suleyman Demirel University

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Development of a mathematical model of the real estate provision system in Kazakhstan

THESIS

Presented in Partial Fulfillment for the
Degree of Master of Science in Mathematics
(degree code: 6M060100)
Department of Computer Sciences
Faculty of Engineering and Natural Sciences

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Kaskelen, 2020

Abstract

This dissertation presents the results of the analysis of state housing programs for citizens of the Republic of Kazakhstan. The main parameters and requirements for making decisions on the housing issues were analyzed in the framework of compliance with the state requirements. As a result of the analysis, a table was developed that includes the main criteria and requirements for the state program, which serves to determine the number of steps and opportunities for obtaining housing in the Republic of Kazakhstan. These analysis results determine the requirements criteria for constructing a mathematical model and assessing the obtaining housing under the state program, depending on the time and steps for implementing the demand of state programs.

The first chapter is Introduction chapter. Where we describe in detail, the current situation in the housing market and the main problems faced by those in need of housing. Chapter 2 is Preliminaries. Here we briefly described the problem that needs to be solved.

In chapter 3, statistics on the provision of housing for citizens of the Republic of Kazakhstan were reviewed. The ratios between the number of new apartments commissioned and the newlyweds by the family are calculated. As well as the relationship between new apartments and demographic growth. The types of social security programs of other countries are considered. In chapter 4, we analyzed the main state housing programs in the Republic of Kazakhstan. All conditions of state and market mortgage lending programs are described. When studying the housing market of the republic, mortgage programs for the acquisition of housing and rental of housing were highlighted. In chapter 5, discussed the results of a study to build a mathematical model to calculate the effectiveness of government programs. The basic parameters of constructing a mathematical model of housing acquisition are described. A mathematical model for the acquisition of housing under existing programs in the Republic of Kazakhstan has been developed. Considered 8 ways to purchase housing. The mathematical model is developed separately for each program. And in chapter 6, we conclude our conclusion. Briefly outlined is the work on the synthesis of housing processes for the main steps. And also it is written about the work done on the analysis of convergence, the identity of processes and operations. The area of use of the mathematical model is described.

Keywords: housing; government programs; housing provision; mathematical model

Аңдатпа

Бұл жұмыста Қазақстан Республикасы азаматтарына арналған тұрғын үй бағдарламаларын талдау нәтижелері көрсетілген. Тұрғын үй мәселесі бойынша шешім қабылдау мақсатында мемлекеттік талаптарға сәйкес құрылған шарттар мен негізгі параметлер талданады. Талдау негізінде мемлекеттік бағдарламалардың негізгі критерилері мен шарттары көрсетілген кесте жасалды. Бұл кесте Қазақстан Республикасында баспана алудың мүмкіндіктері мен негізгі қадамдарын анықтауға бағытталған. Бұл талдау нәтижелері математикалық модель құруға қойылатын талаптардың өлшемін анықтайды. Сонымен қатар мемлекеттік бағдарлама негізінде тұрғын үй алу барысында бағдарламалардың негізгі шарттарын орындауға жұмсалатын уақыт пен өтуге міндетті қадамдардың негізгі критерилерін анықтайды. Бірінші тарау - Кіріспе тарау. Мұнда біз тұрғын үй нарығының ағымдағы жағдайын және тұрғын үйге мұқтаж адамдар тап болатын негізгі мәселелерді егжей-тегжейлі сипаттайтын боламыз. 2 тарау – Бастапқы ақпарат. Мұнда біз шешілуі керек мәселені қысқаша сипаттадық. 3-тарауда Қазақстан Республикасының азаматтарын тұрғын үймен қамтамасыз ету туралы статистикалық мәліметтер қарастырылды. Пайдалануға берілген жаңа пәтерлер саны мен жаңа үйленгендер санының арақатынасы есептеледі. Сондай-ақ, пайдалануға берілетін жаңа пәтерлер саны мен демографиялық өсімнің арақатынасы есптелді. Басқа елдердің әлеуметтік қамсыздандыру бағдарламаларының түрлері қарастырылады. 4-тарауда біз Қазақстан Республикасындағы тұрғын үй құрылысының негізгі мемлекеттік бағдарламаларына талдау жасадық. Ипотекалық несие берудің мемлекеттік және нарықтық бағдарламаларының барлық шарттары сипатталды. Республиканың тұрғын үй нарығын зерделеу кезінде пәтер алу және тұрғын үйді жалға беру бойынша ипотекалық бағдарламалар қарастырылған. 5-тарауда мемлекеттік бағдарламалардың тиімділігін есептеу үшін математикалық модель құру бойынша зерттеу нәтижелері қарастырылады. Тұрғын үй сатып алудың математикалық моделін құрудың негізгі параметрлері сипатталды. Қазақстан Республикасында ағымдағы бағдарламалар бойынша тұрғын үй сатып алудың математикалық моделі жасалды. Тұрғын үй сатып алудың 8 әдісі қарастырылды. Математикалық модель әр бағдарлама үшін бөлек жасалады. Ал 6-тарауда қорытынды жасалды. Бұл тарауда негізгі кезеңдердегі тұрғын үй процестерін синтездеу

жұмыстары қысқаша баяндалған. Сонымен қатар процестер мен операциялардың сәйкестігін талдау бойынша атқарылған жұмыстар туралы жазылған. Математикалық модельді қолдану аймағы сипатталған.

Түйінді сөздер: тұрғын үй; мемлекеттік бағдарламалар; тұрғын үймен қамтамасыз ету, математикалық модель

Аннотация

В данной диссертационной работе представлены результаты анализа государственных жилищных программ для граждан Республики Казахстан. Основные параметры и требования для принятия решений по жилищным вопросам были проанализированы в рамках соответствия государственным требованиям. В результате анализа была разработана таблица, включающая основные критерии и требования к государственной программе, которая служит для определения количества шагов и возможностей получения жилья в Республике Казахстан. Эти результаты анализа определяют критерии требований для построения математической модели и оценки получения жилья в рамках государственной программы в зависимости от времени и этапов реализации требований государственных программ. Первая глава - это введение. Где мы подробно описываем, текущую ситуацию на рынке жилья и основные проблемы, с которыми сталкиваются те, кто нуждается в жилье. Глава 2 - это предварительное рассмотрение существующей задачи. Здесь мы кратко описали проблему, которую необходимо решить. В Главе 3 были рассмотрены статистические данные о предоставлении жилья для граждан Республики Казахстан. Рассчитаны соотношения между количеством введенных в эксплуатацию новых квартир и количеством молодоженов. А также соотношение между количеством сданных в эксплуатацию новых квартир и демографическим ростом. Рассмотрены виды программ социального обеспечения других стран. В главе 4 мы проанализировали основные государственные жилищные программы в Республике Казахстан. Описаны все условия государственных и рыночных программ ипотечного кредитования. При изучении рынка жилья республики были выделены ипотечные программы по приобретению жилья и аренде жилья. В главе 5 рассмотрены результаты исследования по построению математической модели для расчета эффективности государственных программ. Описаны основные параметры построения математической модели приобретения жилья. Разработана математическая модель приобретения жилья по действующим программам в Республике Казахстан. Рассмотрено 8 способов приобретения жилья. Математическая модель разрабатывается отдельно для каждой программы. И в главе 6 мы проводим итоги. В этой главе кратко изложена работа по синтезу жилищных процессов по основным этапам. А также написано о проделанной работе по анализу сходимости,

идентификации процессов и операции. Описана область использования математической модели.

Ключевые слова: жилье; государственные программы; обеспеченность жильем; математическая модель.

Acknowledgements

I would like to express special gratitude to the highly qualified professor Shirali Kadyrov, for the support provided during the writing of the dissertation and teaching the skills to use the necessary programs for writing a dissertation.

And I would also like to express my sincere appreciation and gratitude to my supervisor Baimuratov Olimzhon for help at all stages of the dissertation.

In addition, I want to note the Chairman of the Board and the Director of the Accounting Department of HCSBK JSC for understanding and support during my studies at this university.

Contents

Nomenclature

CIS Commonwealth of Independent States

ECE Economic Commission for Europe

Government for Citizens NJSC State Corporation "Government for Citizens"

HCSBK "House Construction Savings Bank of Kazakhstan" JSC

KMC JSC "MO" Kazakhstan Mortgage Company"

KZT Kazakhstan tenge

LEA Local executive authorities

MCI monthly calculation indicator

OECD Organization for Economic Cooperation and Development

UN United Nations

1. Introduction

1.1 Motivation

The housing problem is the most important among other socio-economic problems of any republic, since important socio-economic interrelations intertwine in it.

The process of Kazakhstan's entry into 30 developed countries of the world is directly related to the formation of a modern housing infrastructure, providing every citizen of Kazakhstan with housing.

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For the formation and development of human capital, an effective housing policy of the state is needed.

There are various models for providing social housing. The models for the distribution of social housing by the Economic Commission for Europe (ECE) are divided into three groups:

1. universal model (social housing is available to the entire population; registration on the waiting list for social housing is required);

2. general model (social housing is distributed among vulnerable households, special groups of the population and households below a certain income threshold);

3. residual model (social housing is provided to vulnerable households, special groups, for example, refugees, asylum seekers, people with disabilities, people with mental retardation, etc.) [40]. A universal distribution model was developed to provide decent and affordable housing for the entire population, regardless of

income [13].

Under the "universal" system, it is believed that the housing stock is managed by the state and provided either through municipal housing companies (for example, in Sweden and Denmark) or through non-profit organizations (in the Netherlands and Denmark) [40]. In 2007, three countries used this system: Denmark, Sweden and the Netherlands. As part of a universal system, social housing is provided very generously compared to other distribution models.

However, over the past 10 years, the views of some states have changed. Since, as a result of applying state support for social housing, competition is created with owners of commercial real estate.

The member states of the Euro Union have chosen different solutions to this problem. Sweden excluded social housing from the category of services of general economic importance, and switched to a market model without the provision of state assistance. In the Netherlands, new restrictions on lower income levels for social housing have been introduced. The general trend is the sale of part of the fund and the transition to a commercial model for entities providing social housing (for example, in Sweden) [15].

Within the framework of the general distribution model, it is assumed that the goals of housing policy will be overwhelmingly realized at the expense of the market. Social housing is intended only for those households for whom the market is not able to provide decent quality housing at affordable prices. In this model, the percentage of social housing as part of the housing system ranges from 0 to 19 percent.

Social housing of a general type is distributed by the providing entity on the basis of a special set of rules and procedures based on the priority criterion based on the ceiling of income. The rental price has a fixed ceiling, and households receive income-based compensation for housing costs that cover part of their rent [40].

The role of the European Commission in the field of housing is to ensure that competition rules are respected. In particular, government subsidies allocated for social purposes should be used precisely for these purposes, and not for financial or commercial activities.

A UNECE study concludes that most transition economies that have introduced social housing policies have used a targeted distribution model since the

1990s. In general, there is a shift towards the residual model. In Europe, the trend towards a residual model is observed in Germany, Belgium, Italy, Luxembourg and Poland [40].

The main causes can be classified as follows:

- residual security due to a significant reduction in funding and due to institutional changes;

- residual security due to high demand for social housing;

- residual security due to the fact that the new social housing policy is at an early stage of implementation, as well as due to limited funding.

The residual approach is aimed at distributing housing to a limited category of beneficiaries, usually the most vulnerable households, which are heavily dependent on state benefits (for example, unemployed, disabled, elderly people, single parents, etc.). In the European Union, social housing for the most vulnerable segments of the population, as a rule, is based on the rigid distribution of this type of housing by local authorities based on needs [40].

In the European Union, rents are calculated on the basis of costs or set based on income levels. A cost-based system is not used in the UK, Ireland or the USA.

Although there are many different definitions of social housing and models, social housing in the UNECE region is increasingly shifting towards the provision of social housing on a "residual" basis. On the western borders of the region, an increase in the share of own housing was achieved by providing relatively easy access to mortgages. In the eastern parts, high rates of home ownership were obtained through privatization of state-owned housing stock. In countries with a developed social housing sector, there was a tendency to reduce social housing stock due to restrictions on construction, sale of the fund to existing residents, as well as demolition [40].

Social housing in Kazakhstan is included in the municipal (state) housing fund, and the right to receive it is not always due to the low level of household income. The number of people applying for public housing, including those with relatively high incomes, is growing; As of 2018, 473,019 waiting lists for housing were registered in the lists of regional executive bodies (akimats), of which 265,053 were socially vulnerable (including orphans and participants in the Great Patriotic War). Current international practice shows that the 2008 economic crisis made housing inaccessible to many poor and middle-class households.

The housing policy of Kazakhstan is aimed at creating conditions conducive to providing the population with affordable housing. Housing construction is one of the priority areas of the Kazakhstan Development Strategy for Kazakhstan until 2030.

However, situation with the provision of housing to the population of Kazakhstan remains low not only against the global background, but also in comparison with the Commonwealth of Independent States (CIS) countries. In accordance with United Nations (UN) international standards, the required norm of the total area of housing, which should be per person, should be 30 square meters, which is significantly higher than the current value in Kazakhstan at the level of 21.6 square meters [2].

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The importance of housing policy and lack of housing are reflected in government programs and official documents of Kazakhstan. The President of Kazakhstan, Kassym-Zhomart Tokayev, on September 2, 2019, in his the Nation Address, instructed to create a Unified Model for Housing Construction and a Unified National Accounting System for waiting lists for rental housing. He also ordered to resolve the issue of providing housing for large families with low-income families and allocated three years for this. This is about 30 thousand people. [55].

However, some experts believe that in such a short time it is not possible to resolve issues of providing housing. For example, the head of the Union of Builders of Kazakhstan T. Ergaliev said that said that design and estimate documentation takes from a year to a year and a half. In addition, it is necessary to allocate land, prepare design documents and reserve money. Within three years, the state may not have time to provide housing for large and low-income families. Even if there is finances, there are land plots and there are projects, it is not possible to build housing in three years, because there is no implementation mechanism [9].

In order to ensure affordable housing for the population of Kazakhstan, the government develops state housing programs, as well as financial support programs for low-income citizens.

Currently, in Kazakhstan, the mechanism for the implementation of housing policy is represented by such tools as: the line for improving housing conditions; housing subsidies for people on the waiting list; the provision of housing to privileged categories of citizens; mortgage credit lending; housing and savings programs; public private partnership.

However, these tools have not yet been fully utilized and their use in practice still raises many questions, from which the problem field of the "real" housing policy is gradually being formed, which is increasingly going beyond the problems of social housing itself.

To address the issue of housing acquisition, especially when choosing the right program, an adequate analysis of existing housing programs is of utmost importance. To select a suitable housing program for the acquisition of housing, it is necessary to analyze all the criteria and requirements of the program.

Several state and market programs have been considered in order to determine the main stages of housing. To get housing under a certain program, it is necessary to go through several stages, spending time on this. And also for the transition to the next stage, it is necessary to fulfill the requirements of the program.

As a result of the work done, tables of the main criteria and requirements of housing programs have been compiled.

Studying all the steps and time to fulfill the basic requirements, each program was divided into several processes and subprocesses. These analysis results will help determine the criteria for the construction of a mathematical model and the assessment of housing under the state program.

1.2 Aims and Objectives

This dissertation is devoted to the construction of a mathematical model to determine the effectiveness of housing programs.

The state housing policy of Kazakhstan is implemented through state housing programs. Since 2005, several state programs aimed at housing construction have been adopted in the Republic.

As a result of the analysis of existing programs, the priorities of the state housing policy of Kazakhstan are changing. For example, when assessing the purchasing power of the population in 2011, it was found that out of 8.4 million people of the economically active population, more than 6 million working citizens cannot buy housing on market conditions, the priority of housing policy has been to increase the availability of housing for citizens middle and lower than average incomes through the construction of rental housing and housing for participants in the housing construction savings system [39].

However, to determine the effectiveness of government housing programs, it is necessary to create a mathematical model. Which will provide transparency and understanding of all the processes associated with housing, that is, the processes of implementing state programs.

Before implementing any state programs, it is necessary to calculate and determine in advance for which categories of the population this program is designed. Will low-income citizens and large families be able to make an initial contribution? What should be the level of income? Calculate the approximate number of citizens who purchase housing. Such questions can be solved by constructing a mathematical model.

Software developers based on a mathematical model can write a program that will ensure transparency and accessibility of implemented programs. Will determine the status or category of the applicant for housing. Thus, the buyer will be able to determine in advance the type of program and the time required to go through the stages of obtaining housing.

In addition, the mathematical model will help to optimize the work of contact centers, reduce the number of calls to bank branches. Thus, it helps optimize the work of front office employees.

1.3 Thesis Outline

The first chapter is Introduction chapter. Where we describe in detail, the current situation in the housing market and the main problems faced by those in need of housing. Chapter 2 is Preliminaries. Here we briefly described the problem that needs to be solved.

In chapter 3, statistics on the provision of housing for citizens of the Republic

of Kazakhstan were reviewed. The ratios between the number of new apartments put into operation by the number of newlyweds are calculated. As well as the ratio between the number of new apartments commissioned and demographic growth. The types of social security programs of other countries are considered. In chapter 4, we analyzed the main state housing programs in the Republic of Kazakhstan. All conditions of state and market mortgage lending programs are described. When studying the housing market of the republic, mortgage programs for the acquisition of housing and rental of housing were highlighted. In chapter 5, methods for constructing a mathematical model are discussed. Showing mathematical models of the acquisition of housing. The mathematical model is built for 8 types of different ways of acquiring housing. And in chapter 6, we conclude our conclusion.

1.4 Background of Literature Review

Housing problems require an immediate solution and universal effort because of their widespread and important for social stability. Housing shortages and the importance of housing policies are addressed in government programs and official documents of Kazakhstan.

Political and economic problems of the housing sector and housing reform were investigated in the works of domestic and foreign scientists.

Many authors from different countries devote articles on solving housing problems, which describe the designing of a shelter policy, the organization of the housing finance market, the introduction of fiscal incentives, increased public investment in detail Mahadeva M. [33], Kulumbetova L.B. [31], Xin Lia [32], Kleinhansa R. [32], Lü Junhua [27].

Peculiarities of the investment process in residential real estate are considered by such scientists as W. Eucken [17], N. Ordway [19], D. Friedman [19], L. Erhard [16]. Issues of the functioning of the economy of the housing sector as part of the market system are investigated in the works of N.B. Kosareva [57], A.S. Puzanov [57], G. Polyakovsky [49].

The issues of social housing and the involvement of non-governmental non-profit organizations in solving housing problems were studied in the works of D. Clapham [10], H. Cope [12], M. McDermont [37], P. Malpass [34] A. March [36].

In addition, various aspects of the housing sector and the policies of Kazakhstan were considered in the works of A. Bisenova [7], M. Gentail [20], R.A. Dodder [71], G.E. Zaynullina [71], G.Zh. Zainullina [71], E. Maltseva [35], T. Tammaru [20], D. Sharipova [59].

The relevance of housing in the Republic of Kazakhstan is due to the growth of the economy, the level of welfare of the population and its desire to improve housing conditions. The problem of housing is certainly the most relevant among the population. There are many who wish to improve their living conditions. A wide range of services is open before them, it remains only to choose what is acceptable for each according to their individual capabilities SHalbolova, U.ZH. [58].

Significantly less interesting and relevant materials are devoted to studying the issue of the effectiveness of state programs themselves, and in those works that have nevertheless been published on this topic Volosov A.I. [70], Pirogova E.V. [48], Vladimirov S.A. [68], Volosov A.I. [69], the main emphasis is on the analysis of government spending exclusively as investments, which inherently involve direct or indirect economic benefit of the state, which cannot be, as noted above, the main goal of state programs on accessibility for ordinary citizens.

Mortgages are not available to many citizens. Moreover, the desire of the majority of the population to improve their living conditions is relevant, therefore, the construction of public housing is the main direction of the housing policy of the Republic of Kazakhstan Kassenova G. E. [28], Ismailov T. [26].

Housing affordability is covered in many articles.

2. Preliminaries

In accordance with the Law on Housing Relations (section 67 and 68), dwellings from a communal housing stock or dwellings rented by a local executive body in a private housing stock are provided for use to citizens in need of housing in the following categories [62]:

1. Disabled people and participants in the Great Patriotic War.

2. Orphans, children without parental care.

3. Socially vulnerable groups of citizens:

- persons equated with disabilities and participants in the Great Patriotic War;

- disabled people of groups 1 and 2;

- families with or raising children with disabilities;

- persons suffering from severe forms of certain chronic diseases;

- retirees by age;

- oralmans (ethnic Kazakhs who arrived in the Republic of Kazakhstan for permanent residence in their historical homeland);

- persons who have lost their homes as a result of environmental disasters, natural and man-made emergencies;

- large families (a family with four or more children);

-single-parent families.

Social housing is provided to persons from this group provided that their total average monthly income for the last twelve months before applying for housing for each family member is lower than the 3.1 times living wage established for the corresponding fiscal year by the law on the republican budget.

4. Civil servants, employees of budgetary organizations, military personnel, candidates for astronauts, astronauts, employees of special state bodies and persons holding public elected posts (the housing provided to such citizens from the communal housing fund is equivalent to official housing).

5. Citizens of the Republic of Kazakhstan, whose only dwelling is recognized as emergency in the manner prescribed by the legislation of the Republic of Kazakhstan (such citizens, upon receipt of housing from the communal housing stock, transfer the emergency housing available on the right of ownership to communal ownership).

In order to ensure targeted support and efficient use of public funds, in 2019, the service software product "Unified Republican Electronic Database of Waiting Queues" was put into commercial operation [43].

Housing issues of citizens is a priority for the state. Through the mechanisms of existing programs, the state plans to provide housing for citizens of Kazakhstan with different income levels.

Today, there are various ways to purchase housing. To calculate the effectiveness of existing programs, it is necessary to develop a mathematical model that will ensure transparency and understanding of all processes related to housing, that is, processes for the implementation of government programs.

3. Analysis of the real estate market

The construction of affordable housing plays a large role in the real estate market. On it you can determine the level of development of society and its productivity. The provision of housing to the population and its accessibility affect the standard of living, fertility, and economic culture. Today, the policy in the field of housing affordability in Kazakhstan is a priority. At the present stage, the regional policy of Kazakhstan is designed to ensure the formation of a rational territorial organization, which includes the promotion of urbanization processes and the controlled development of agglomerations, which are the most important points of economic growth of the national economy, development and support of promising localities with economic and demographic potential.

Urbanization today is one of the main trends in the development of the world, now the population of cities has exceeded the number of people living in rural areas [64].

In developed countries, three quarters of the population lives in cities: in the UK, the level of urbanization reaches 82.3%, in the USA - 81.4%, in France - 79.3%, in Germany - 75.1%. According to UN forecasts, by 2050, 6.2 billion people will live in cities, which will be 66% of the total population of the earth.

3.1 Housing statistics in the Republic of Kazakhstan

At present, Kazakhstan has a large number of socially significant problems that require urgent solutions, one of which is providing the population with housing.

The provision of housing in Kazakhstan has increased since 2008 by 21 per cent

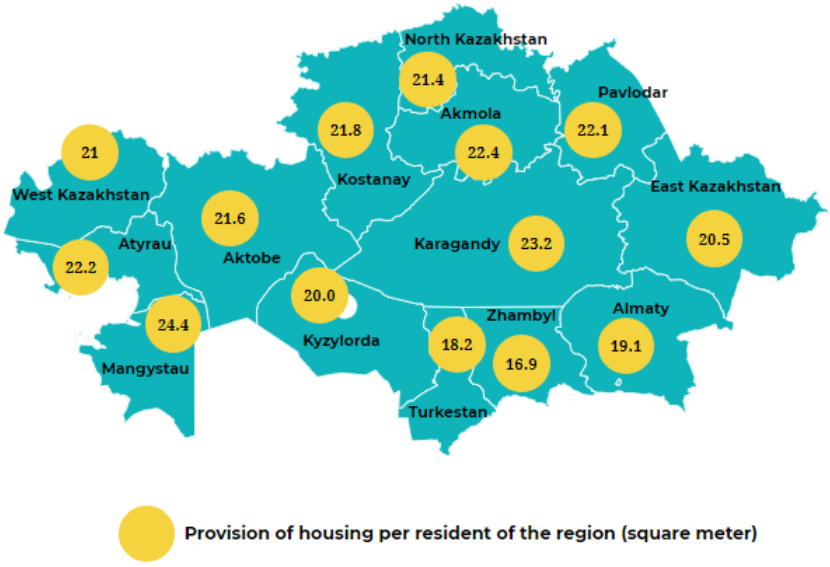


Figure 3.1: Provision of housing for one resident in the regions for 2018 (sq.m).

and amounted to 21.9 square meters. meters per person by 2018 [25]. According to the developed social standards of the United Nations, at least 30 sq.m.(see Figure 3.1, Figure 3.2).

Housing conditions are one of the main elements of human life. Housing is not only four walls and a roof, it should be a place for sleep and relaxation, where people feel safe, have their own personal space. The number of rooms in the house, divided by the number of people living in it, determines whether people live in cramped conditions. Inadequacy of a square meter can adversely affect the physical and mental health of a person, relationships with other people and the development of children.

The Organization for Economic Cooperation and Development (hereinafter - OECD) provides data on developed countries where you can see how many rooms are available per person: in Russia, Turkey and Mexico (1 room each), Canada (2.6 rooms), and the UK (1.9 rooms), in Germany (1.8 rooms) and high rates are New Zealand and the USA (2.4 rooms each) [47].

To solve the problem of improving the housing problem, it is necessary to take into account the experience of foreign countries. The experience of developed countries shows that for moderate periods (throughout the life cycle of one generation), construction activity should be about 1 square meters per inhabitant per year. For example, during the intensive solution of the housing problem in Japan, 0.9 - 1 square meter of housing per person was built annually, in the USA - 0.7 -

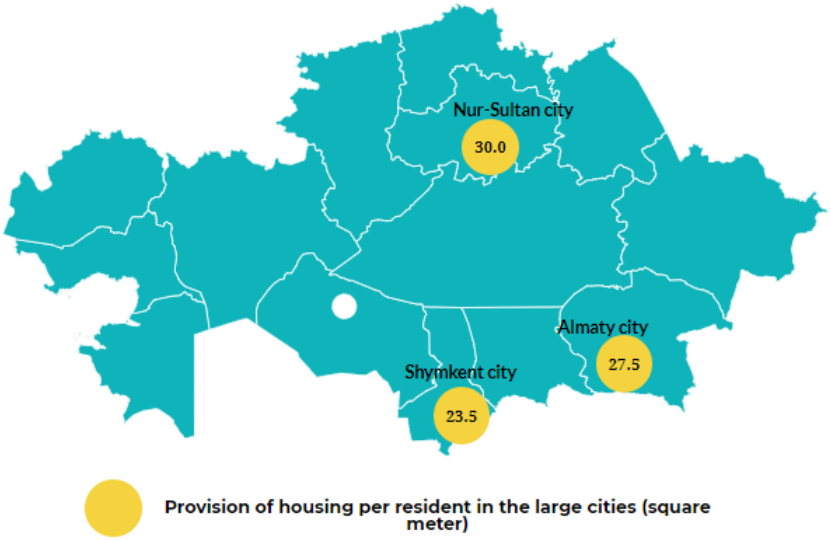


Figure 3.2: Provision of housing for one resident of cities of republican significance in 2018 (sq.m).

Country	Population (people)	Housing (sq.m)
China	1 392 730 000	32
USA	323 127 513	69.7
Russia	146 780 700	23.4
Germany	82 792 351	39
Great Britain	66 273 576	70
Poland	37 976 687	25

Figure 3.3: Population and housing per person in some developed countries.

0.8 square meters, in France and Germany - about 0.7 square meters. China has long supported building activity at the level of 1 square meters per person [41].

Demographic data. A stable positive trend is maintained in demographic indicators, the population of Kazakhstan as of December 1, 2019 amounted to 18611.1 thousand people, including urban - 10875.7 thousand people (58.4 %), rural - 7735.4 thousand people (41.6%) [25]. Compared to December 1, 2018, the population increased by 234.9 thousand people or 1.3 %. For the period under review, the largest overall increase was observed in 3 regions of the country: Nur-Sultan (61.7 thousand people), Almaty (57.8 thousand people) and Turkestan region (38.4 thousand people).

Incomes of the population and the cost of living. The average per capita nominal cash income of the population as estimated in October 2019 amounted to 106,001 tenge, which is 5.6% higher than in October 2018, real cash income for the specified period increased by 0.1%.

In the sectoral structure, the highest nominal wages were noted in mining and quarrying - 428.3 thousand tenge (2.1 times higher than the national average), in financial and insurance activities - 402.5 thousand tenge (2.0 times), in the field of professional, scientific and technical activities - 373.4 thousand tenge (1.8 times), in the field of information and communication - 278.0 thousand tenge (1.4 times) [61].

The lowest level of nominal wages was noted in agriculture, forestry and fisheries - 127.3 thousand tenge, which is 37.6 % lower than the national average. From January 1, 2020 the minimum wage is set at 42,500 tenge.

Volume of commissioning of residential buildings

According to the Committee on Statistics [25], the total housing area of the Republic of Kazakhstan for 2018 amounted to 356.4 million square meters, including 226.1 million square meters in urban areas and 130.2 million square meters in the countryside (see Figure 3.4).

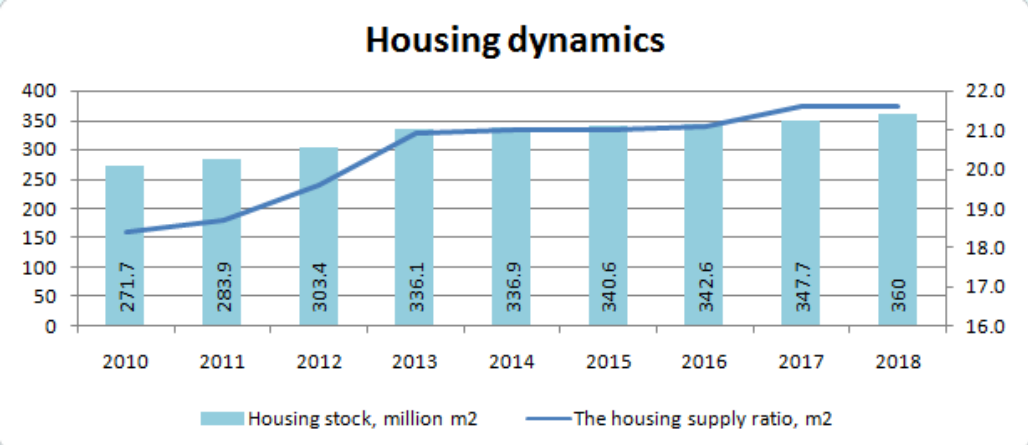


Figure 3.4: Growth dynamics of the total area of housing in the Republic of Kazakhstan

In January – December 2018, 1,162 billion tenge was allocated for housing construction, which is 8.1% more than in 2017. Of the total number of residential buildings, 37,376 individual houses were commissioned, 1,237 multi-apartment buildings were commissioned, 113.7 thousand apartments were built, which is 12.8 percent more than in 2017 [61].

The total area of commissioned residential buildings in 2019 increased by 4.9 % [61] and amounted to 13 133,8 thousand sq.meters (see Figure 3.5).

Most of the housing - 11 268,9 thousand square meters or 86% commissioned by private developers, of which a population of 6 540,6 thousand square meters,

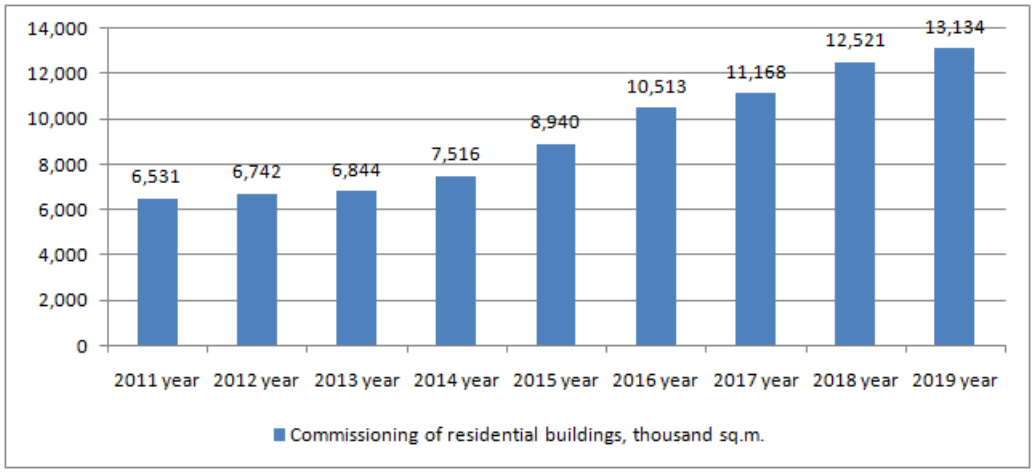


Figure 3.5: Commissioning of residential buildings, thousand sq.m.

which in the total volume of input is 50%.

Significant growth was noted in Turkestan region (1.6 times), Almaty (1.2 times), Shymkent (1.2 times).

From January 1 - December 31, 2019, the volume of construction work (services) amounted to 4 416,79 billion tenge. The largest volume of the total volume of construction work in the republic was carried out by private construction organizations 88.28%, foreign - 11.57%, state - 0.16%. From January 1 to December 31, 2019, 1,423.0 billion tenge was allocated for housing construction (see Figure 3.6), which is 16.9% more than in 2018. A significant increase in housing investment (99.8%) is shown in the Turkestan region. This is primarily due to obtaining the status of a regional center, relocation of regional authorities and, accordingly, with the active construction of residential buildings.

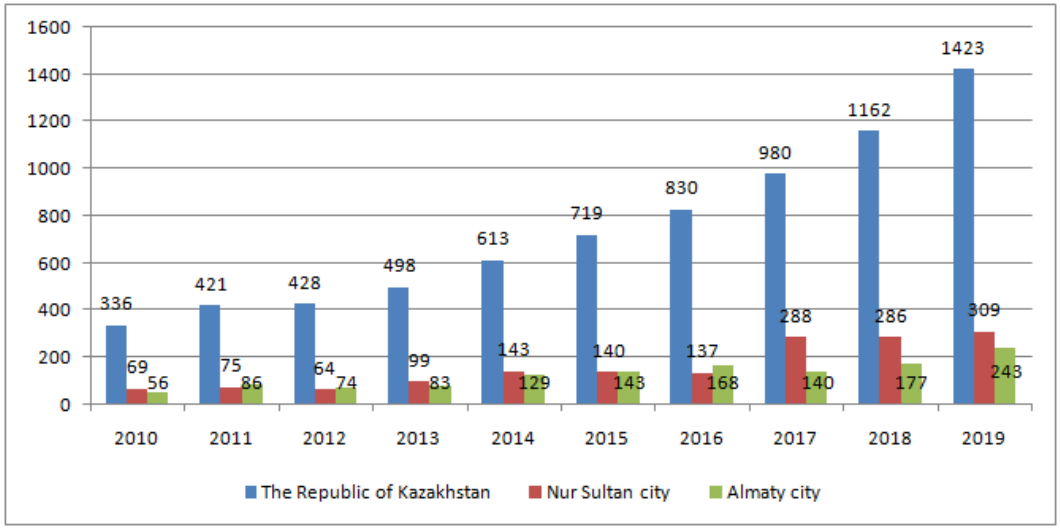


Figure 3.6: Investments in housing construction (billion tenge)

Real estate price dynamics. In December 2019, compared with the same period in 2018, the national average selling price of one square meter of new housing increased by 6.4% and amounted to 293,5 thousand tenge, resale of landscaped apartments, respectively - by 6.2% and amounted to 200,4 thousand tenge.

Five cities of the Republic of Kazakhstan with the most expensive new housing per 1 sq.m. in December 2019:

1. Nur-Sultan - 373.7 thousand tenge;
2. Almaty - 357.2 thousand tenge;
3. Shymkent - 330.3 thousand tenge;
4. Atyrau - 326.1 thousand tenge;
5. Aktau - 284.6 thousand tenge.

Five cities of the Republic of Kazakhstan with low prices for 1 square. m. for new housing in December 2019:

1. Taraz - 140 thousand tenge;
2. Petropavlovsk - 140 thousand tenge;
3. Kyzylorda - 141 thousand tenge;
4. Aktobe - 158.6 thousand tenge;
5. Uralsk - 166.4 thousand tenge.

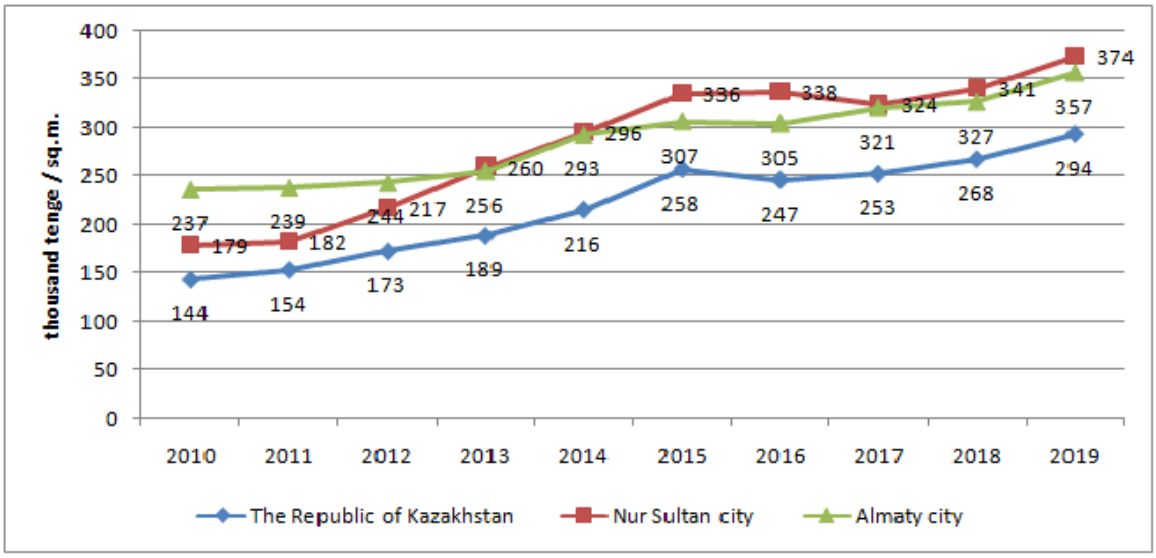


Figure 3.7: Selling prices of new housing, thousand tenge 1 sq.m.

The average rental price of comfortable housing in the Republic of Kazakhstan for December 2019 amounted to 1,500 tenge per 1 sq. Km. m., growth by December of the previous year amounted to 7.1%.

In December 2019, the highest rental price was recorded in Nur-Sultan (2,821 tenge per 1 sq.m.), Almaty (2 332 tenge per 1 sq.m.), Aktau (2 047 tenge per 1 sq.m.), Turkestan (1 801 tenge per 1 sq. M.) Atyrau (1 759 tenge per 1 sq.m.), Karaganda (1 586 tenge per 1 sq.m.). In other major cities, this indicator is below the national average.

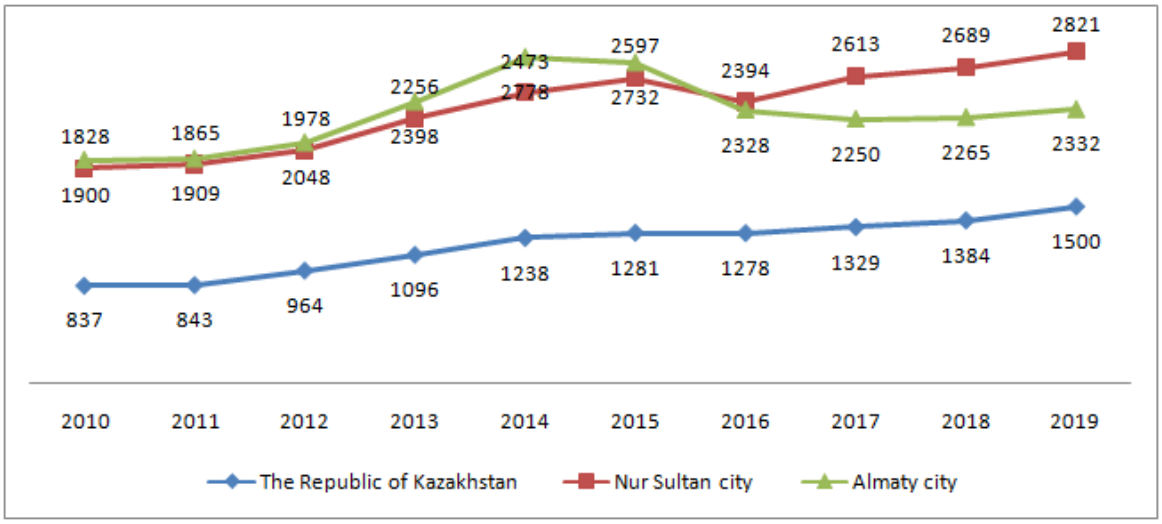


Figure 3.8: The price of renting comfortable housing in the Republic of Kazakhstan

The number of newlyweds/divorced. According to the statistics of the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan, the number of registered marriages is more than one hundred thirty thousand annually: 2014 - 159 328; 2015 - 148 769; 2016 - 141 702; 2017 - 141 791; 2018 - 137 797 [61].

However, the number of registered divorces is not decreasing and amounts to more than fifty thousand annually: 2014 - 52 673; 2015 - 53 293; 2016 - 51 993; 2017 - 54 626; 2018 - 54 797 [61].

Difficult living conditions and early marriage are also a common cause of frustration. For example, often the newlyweds live together with the parents of the husband or wife, and this entails a whole loop of problems that are associated with the intervention of the parents. Conflicts arise between generations, and the spouse who brought his chosen one to the parental home cannot always obtain respect from his parents for a young family and defend the right to independence [67].

Thus, one of the factors influencing the growth of indicators on family divorce is the housing issue. Families without separate housing are forced to live with

their parents, even if the total area of the apartment does not allow.

Here are the calculations for the provision of housing according to the data for 2018.

The population growth is more than two hundred thousand people annually: 2014. - 254 860; 2015 - 254 181; 2016 -248 318; 2017 - 239 123; 2018 - 238 230 [61]. Over the past five years, the number of new apartments has doubled: from 63 743 (2014) to 113 485 (2018) [61].

First of all, we calculate the ratio between the number of apartments commissioned for population growth. To do this, we divide the number of new apartments by the number of demographics increase: 113 845/238 320 = 0.48 (2018 year).

Thus, it can be seen that the number of new apartments commissioned is not enough for the population of Kazakhstan.

Secondly, we calculate the calculation of housing provision for the newlyweds. For this, the number of new apartments is divided by the number of newlyweds: 113 485/137 797 = 0.82 (2018 year). According to these indicators, you can also clearly see the lack of housing.

One of the main goals of state programs is to increase the availability and comfort of housing. The determining factor for solving housing issues of citizens is their income, as well as the availability of sufficient volumes of affordable housing.

3.2 International Housing Support Experience

Strict requirements for borrowers by lenders and the high cost of a mortgage loan do not allow most of the country's population to improve their living conditions with the help of mortgage lending. The way out in this situation is government support, which implies the provision of various benefits and subsidies in the lending process, aimed mainly at the borrowers themselves.

It makes sense to get acquainted with the foreign system of state support for the population in the field of housing.

1. Russian Federation.

The Federal Target Program "Housing" for 2016–2020 is in force in Russia. This program has the following subroutines:

1) provision of housing for young families;

2) the fulfillment of state obligations to provide housing for categories of citi-

zens established by federal legislation;

3) stimulation of housing development programs of the constituent entities of the Russian Federation;

4) provision of housing for certain categories of citizens;

5) modernization of public utilities infrastructure.

Support measures under the “Housing for the Russian Family” sub-program are:

1) providing support for the construction of engineering infrastructure through funding to ensure the purchase of engineering and technical support facilities by issuing bonds with collateral;

2) providing developers - participants of the program "Housing for the Russian family" preferential credit conditions with an interest rate from 9.5 percent to 13 percent [60].

Turkey.

The main authorized bodies in the field of regulation of housing policy in Turkey are:

1) The Ministry of Public Works and Housing (Ministry);

2) Housing Management Turkey (TOKI). In the framework of the urgent action plan of the Government of Turkey, since 2003, measures have been taken to provide low-income people with housing and relocate the residents of dilapidated houses to modern housing complexes. Thus, by the end of 2011, TOKi built approximately 202,000 houses for middle-class Turkish citizens and 140,000 houses for low-income and poor families. It is planned that TOKi will build about 500,000 residential buildings in Turkey by 2023. For low-income segments of the population who do not have a permanent income or with a low income level, rental housing is available ranging from 45 to 65 square meters with a monthly payment of 80 with a maturity of more than 20 years. In this case, housing payment is made only 2 years after the settlement. Families of the fallen soldiers, war invalids, their widows and orphans are granted interest-free loans for housing construction [60].

China.

Reform in housing policy is an important component of the Chinese economic system. The Affordable Housing Program, which was approved in 1999, is designed to provide cheaper housing for low-income families. In general, the housing

program consists of four mechanisms:

1) public housing construction for low-income families;

2) public rental housing (one of the methods of providing housing for the population is the mechanism by which the state purchases housing on the secondary market and leases it to citizens in need without a buyout right);

3) housing construction at the expense of private developers (this mechanism provides for meeting the demand for housing by providing the opportunity to purchase residential space from private developers for a price significantly lower than the market, while stimulating measures for private developers are the provision of land by the state, tax breaks, as well as interest rate subsidies);

4) housing subsidies (this mechanism provides for the allocation of state subsidies to certain categories of low-income citizens for the purchase of housing, as well as the costs associated with its rental and maintenance) [60].

Thus, in 2015, the Government of China allocated 20.2 billion dollars to finance the Affordable Housing Program. These funds were used as housing subsidies for low-income families.

Switzerland.

The fundamentals of Swiss housing policy are the provision of financial support by the state to developers and landlords, as well as the provision of subsidies. The main subjects of state support are builders of housing for public needs (public funds, housing cooperatives, etc.). Housing built by these entities is cheaper than housing of other investors, which allows to significantly reduce the rent for its individual categories of citizens. The state at the federal, cantonal and municipal levels supports the creation and functioning of organizations that build housing for public needs. The state also stimulates their activities by providing soft loans, subsidies, tax preferences, land plots at low prices, and the provision of guarantees.

Farther, Housing finance schemes in Singapore are considered in detail.

Various measures must be taken to increase housing affordability. If you consider the housing policy of Singapore, you can see that the share of public housing is more than 80 per cent of the country's total housing stock. In Singapore, there is a Housing and Development Board - the HDB (Housing and Development Board), which was created in 1960 to address the housing crisis. HDB, after its entry into force, built 21,000 apartments in less than 3 years; 2 years later, this number was 54,000 apartments. In a short span of 10 years, HDB built enough apartments for

Singaporeans and resolved the housing crisis. About 1 (one) million apartments have already been built for Singapore with a population of 5.7 million people [22].

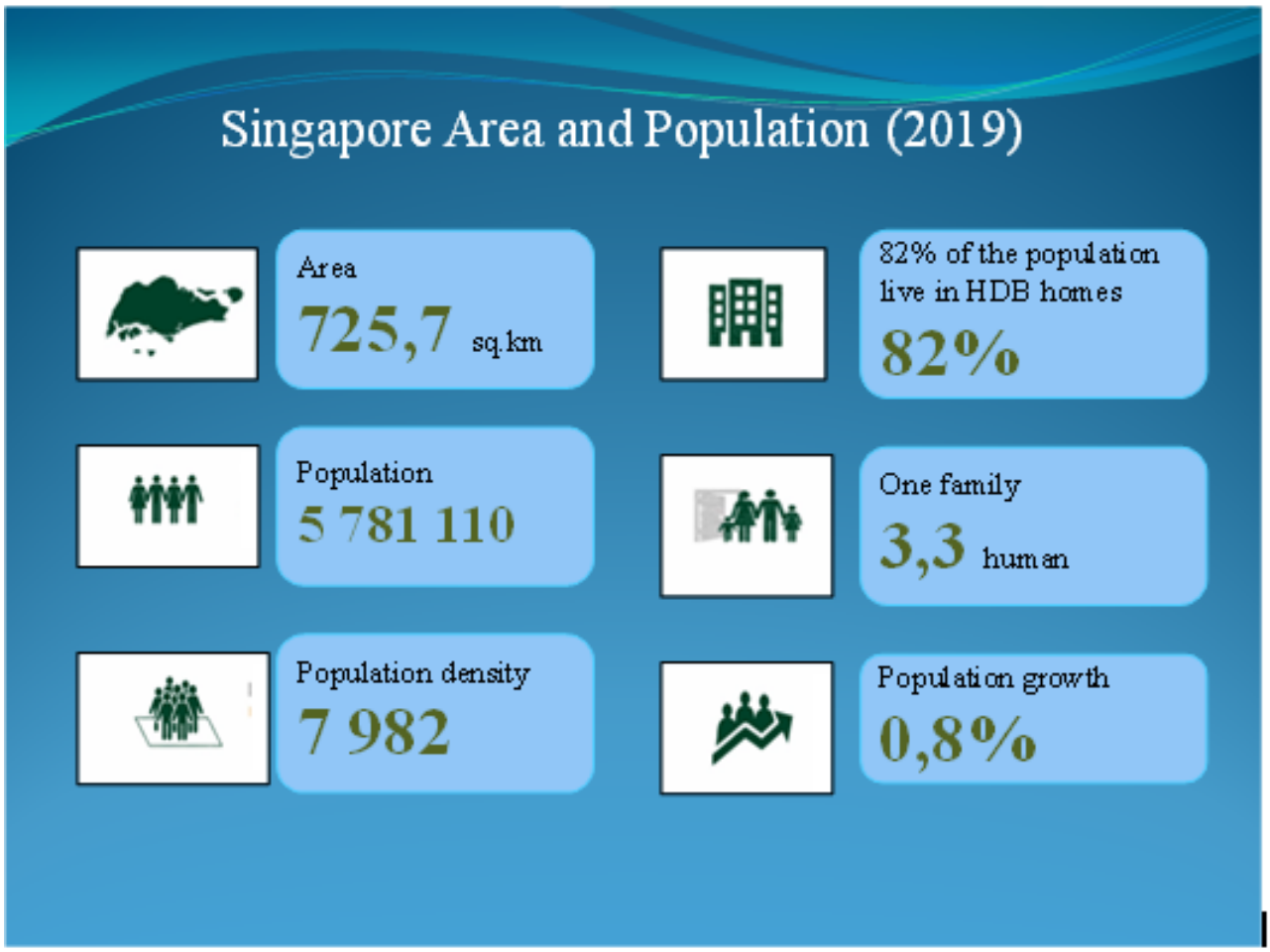


Figure 3.9: Demographic indicators of Singapore and the total area of the country

The main tools for the sale of housing: rental, followed by redemption and direct redemption. HDB Tasks:

1. A variety of house designs for sale and rent;
2. Adequate government subsidies to ensure affordable housing;
3. The development of an active secondary market for public housing;
4. Development of clear and transparent rules governing the purchase and sale of public housing, the prevention of speculation in the real estate market

HDB is actively involved in research and development to ensure that standards of cost-effectiveness and quality are maintained and continuously improved.

All working citizens of Singapore and their employers pay mandatory fixed monthly contributions to the Central Provident Fund (CPF) [8]. CPF is a comprehensive social security system that allows working citizens and permanent res-

idents of Singapore to save for retirement. It also addresses healthcare, home ownership, family protection, and asset improvement.

Employee Age (years)	Deduction rate (for a monthly salary of more than $ 750)			Distribution rate		
	Deduction by the employer (% of monthly earnings)	Employee deductions (% of monthly earnings)	Total deductions (% of monthly earnings)	To a regular account (% of monthly earnings)	To a special account (% of monthly earnings)	To Medisave account (% of monthly earnings)
35 and younger	17	20	37	23	6	8
35-45	17	20	37	21	7	9
45-50	17	20	37	19	8	10
50-55	17	20	37	15	11,5	10,5
55-60	13	13	26	12	3,5	10,5
60-65	9	7,5	16,5	3,5	2,5	10,5
Over 65	7,5	5	12,5	1	1	10,5

Figure 3.10: Rates of deductions and distributions of CPF (from January 1, 2016)

In 1968, to help more homeowners, the government allowed the use of the Central Collateral Fund (CPF) savings for down payments and for servicing monthly mortgage payments. This, along with other schemes and grants introduced over the years, has made home ownership very affordable and attractive.

In addition, other grants have been introduced to help home buyers afford HDB apartments. Thus, buyers will need to use less than a quarter of their monthly family income to pay the mortgage payment for their first apartment, which is below the international indicators of affordable housing.

Initially, HDB apartments were simple and utilitarian in order to optimize the use of space and reduce maintenance costs [22].

4. Analysis of housing distribution programs in the Republic of Kazakhstan

4.1 Government programs and ways to obtain housing

In Kazakhstan, there are several types of housing acquisition programs for the general population. Consider several options for obtaining housing, such as: the rental housing without redemption [54], the mortgage lending program “Бақытты отбасы” [65], the social housing of Local Executive Authorities (Akimats) [60], the program "7-20-25" [56], the market program "Баспана Хит" [66], the rent-to-own basis housing through the Kazakhstan Mortgage Company (KMC) [42], the mortgage "Орда" from KMC [38], housing for military service persons and employees of special government agencies through "House Construction Savings Bank of Kazakhstan" JSC [65].

4.1.1 The rental housing without redemption

Citizens of the Republic of Kazakhstan, who are defined in article 68 of the Law "On Housing Relations" of the Republic of Kazakhstan and working youth [50], can obtain rental housing without the right of purchase. In addition, rental housing without redemption will be issued to working youth who have not reached 29 years of age, receiving an official income of at least 40 MCI $= 40 \times 2778 =$ 111120 tenge in 2020. Non-repurchased rental housing is provided for 5 years [54].

After publishing on the Internet site of the local executive body an announcement about the start of accepting an application for rental housing without the right to purchase, applicants must submit a list of documents to the Government for Citizens at the place of residence or submit documents through the portal of the Electronic Government by clicking on the link: $Home \rightarrow For \quad citizens \rightarrow Real \quad Estate \rightarrow Buying, \quad selling, \quad renting$ [24]. Check for completeness of documents is carried out within 5 (five) business days after the end of the reception of documents. If the applicant does not meet the requirements of the State Housing Construction Program "Nurly zher" and the “Rules for the provision of rental housing without the right to purchase for working youth”, a written refusal is provided. Scoring and compilation of a list of applicants for rental housing without the right to purchase is carried out within 10 working days. Points are awarded as follows: 1. If the applicant has mastered the profession according to the list of 100 specialties most demanded by the market - 10 points; 2. the presence of a family - 5 points, for each year in a registered marriage - 2 points; 3. for one child - 1 point, for each subsequent child - 2 points; 4. if carries out individual entrepreneurial activity for at least 1 year - 5 points, for each year - 1 point; 5. for the presence of personal achievements of the applicant in various fields of activity - 2 points; 6. for labor activity in budget organizations (state institutions and state enterprises) - 5 points, for each year of service - 1 point; 7. for each year of savings in savings accounts (deposits) in second-tier banks - 2 points. The lease agreement is concluded by the authorized body within 15 calendar days after the decision on the provision of rental housing without the right to purchase [54]. The amount of the lease payment is calculated by the LEB in accordance with paragraph 1 of Article 97 of the Law of the Republic of Kazakhstan “On Housing Relations” and in accordance with the Methodology for calculating the amount of payment for using housing from the state housing stock [5], [45].

4.1.2 The mortgage lending program “Bakytty otbasy”

“Бақытты отбасы” (Bakytty otbasy) is the direction of the “Nurly zher” State Housing Construction Program for lending to low-income families through the "House Construction Savings Bank of Kazakhstan" JSC (hereinafter - HCSBK).

Program participants can be citizens who are registered in need of housing in accordance with the Law of the Republic of Kazakhstan "On Housing Relations", by categories: mothers with many children, awarded with pendants "Altyn alka", "Kumis alka" or previously awarded the title "Mother Heroine" as well as those awarded with the orders of "Mother Glory" of the I and II degrees, large families; single-parent families; families with or raising children with disabilities [50].

Requirements for applicants for a soft loan at 2 percent per annum:

1) citizenship of the Republic of Kazakhstan;

2) the presence of income from labor and (or) entrepreneurial activity (excluding pension contributions, individual income tax and other mandatory contributions) for the last 6 (six) months, not exceeding twice the subsistence level for each family member (in 2020 is 62 366 tenge) approved by the law on the republican budget for the corresponding financial year;

3) the expiration of a 3-year period from the date of divorce (for single-parent families);

4) confirmation of solvency;

5) confirmation of the registration and registration certificate of the registration in need of housing and the status of needing housing in the prescribed categories of participants in accordance with the Law of the Republic of Kazakhstan "On Housing Relations".

After calculating the solvency of the program participant, the Bank issues a notification on the possibility of lending indicating the amount of the loan, which the applicant can apply for. Three months are provided for the search for housing in a new building or in the secondary housing market. After choosing a housing, it is necessary to assess the real estate and provide to the HCSBK together with copies of documents for housing [72], [11], [51].

The maximum loan amount is 15 million tenge in the cities of Nur-Sultan, Almaty, Shymkent, Aktau, Atyrau and 10 million KZT in other regions. Loan repayment period - up to 20 years. Down payment - 10 per cent of the cost of housing. There is an opportunity for participants in the "Bakytty otbasy" program to purchase primary housing to receive a housing certificate through LEA in the amount of 1 million tenge [30].

4.1.3 Social Credit Housing of Local Executive Authorities

The conditions for the sale of credit housing, the procedure for interaction between the Local Executive Authorities (hereinafter - LEA) and HCSBK, as well as the volume of sales of credit housing through the HCSBK to the participants of the Program are determined by the agreement between the LEA and HCSBK, and internal documents of the HCSBK [50].

Procedures for the selection of applicants and the distribution of housing are carried out from the date of receipt of information from the LEA regarding the property being sold. LEA not later than 3 (three) months prior to the date of commissioning of the facility provides the Bank with an application for approval of facilities. At the same time, "Credit housing of LEA" is sold to depositors and waiting lists of LEA through HCSBK within 6 (six) months [45], [44].

After concluding a memorandum of intentions between the Bank and the LEA, the LEA at least once a quarter sends to the HCSBK lists of the waiting lists of the LEA. Upon receipt of an updated list from the LEA, the HCSBK enters the information received into the database of depositors.

HCSBK provides preliminary housing and intermediate housing loans at a rate of not more than 5 per cent per annum with a loan term of up to 25 (twenty five) years if there is an initial payment on the account in HCSBK:

• for preliminary housing loans in the amount of at least 20 (twenty) percent of the loan amount;

• for interim housing loans in the amount determined by the Law of the Republic of Kazakhstan dated December 7, 2000 «On Housing Construction Savings in the Republic of Kazakhstan».

Basic requirements for participants [50]:

1) citizenship of the Republic of Kazakhstan;

2) the presence of income from labor and (or) entrepreneurial activity (excluding pension contributions, individual income tax and other mandatory contributions) for the last 6 (six) months for each family member up to 3.1 the subsistence level inclusive, approved by law about the republican budget for the corresponding financial year;

3) confirmation of the registration and registration certificate of the registration in need of housing and status in need of housing in accordance with the Law of the Republic of Kazakhstan "On Housing Relations";

4) confirmation of solvency.

At the end of the selection procedures, the HCSBK submits to the LEA the final lists of participants. The list shall indicate the identification number and address of the housing for the execution of the real estate purchase and sale contract.

In the case of shortage of applicants for realizable housing among the LEA waiting list, the HCSBK carries out selection without applying a point system according to the internal documents of the HCSBK, including among depositors of the HCSBK who are not the queues of the LEA.

At the same time, HCSBK depositors confirm:

- permanent registration at the place of residence in the cities of Nur-Sultan and Almaty, at least 2 (two) recent years on the date of application for applicants applying for housing in these cities;

-the absence on the territory of the Republic of Kazakhstan of the applicant and his family members permanently living with him (spouse, minor children), as well as other family members included in the family and specified in the application, rental housing with purchase or housing on the basis of ownership (common joint ownership, a share in shared ownership constituting the common joint (shared) ownership of other family members referred to in this paragraph as a housing unit), with the exception of:

• the availability of housing with a useful area of less than 15 (fifteen) square meters per family member;

• residential houses of adobe and frame-reed type in disrepair, threatening a collapse (collapse).

4.1.4 The program “7-20-25”

“7-20-25” - a mortgage program that provides new opportunities for improving housing conditions. A program participant chooses housing in the primary market from the developer. The maximum cost of housing is 25 million KZT for the cities of Nur-Sultan, Almaty, Aktau, Atyrau, Shymkent and 15 million KZT for other regions [56].

Applicants for housing under the “7-20-25" mortgage program must meet the following requirements [50]:

1) the presence of income in excess of 3.1 living wages from labor and (or)

entrepreneurial activity, confirmed by one of the following documents at the discretion of the bank;

2) the absence of debt on mortgage housing loans under the mortgage program «7-20-25» and other mortgage housing loans, confirmed by the credit report of the credit bureau;

3) the absence of housing on the right of ownership in the Republic of Kazakhstan, confirmed by the information of the legal cadastre with the exception of:

• the availability of rooms in dormitories with a useful area of less than 15 square meters per family member;

• housing, which is recognized as emergency in the manner prescribed by the State standards in the field of architecture, urban planning and construction of the Republic of Kazakhstan.

Prior to issuing a mortgage housing loan, second-tier banks, in accordance with the requirements of the legislation of the Republic of Kazakhstan and internal documents of the bank, assess the creditworthiness of the borrower [52], [53].

Partner banks (program operators): Halyk Bank of Kazakhstan JSC, Bank Center Credit JSC, SB Sberbank JSC, Jysan bank JSC, ATF Bank JSC, Forte bank JSC, Bank RBK JSC, JSC Eurasian Bank [56].

4.1.5 The market program “Baspana Hit”

The “Баспана Хит" (Basapana Hit) is the Baspana Mortgage Organization’s own program for lending to primary and secondary housing. The "Баспана Хит" program is not a state program; it does not have the restrictions and requirements for applicants that are in the "7-20-25” program [66].

Maximum cost of purchased housing: 25 million KZT for the cities of Astana, Almaty, Aktau, Atyrau and 15 million KZT for other regions. The interest rate is 13.75 % per annum. Loan term - up to 15 years.

Requirements: citizenship of the Republic of Kazakhstan; confirmation of solvency; lack of other mortgage loans. Housing can be purchased in all regions of Kazakhstan.

Partner banks (program operators): Halyk Bank of Kazakhstan JSC, Bank Center Credit JSC, SB Sberbank JSC, Jysan bank JSC, ATF Bank JSC, Forte bank JSC, Bank RBK JSC, JSC Eurasian Bank [66], [52], [53].

4.1.6 Housing on a rent-to-own basis for education and healthcare workers.

Within the framework of the State program for housing and communal development “Нұрлы жер” for 2020-2025, JSC “MO “Kazakhstan Mortgage Company” (hereinafter - KMC) works in the direction of rental housing with the right to buy for education and health workers [42], [41].

Leased housing with redemption is realized by the waiting lists of the LEA, in the order of priority determined in accordance with the current housing legislation of the Republic of Kazakhstan, for the following categories [63] : - large families; - single-parent families; - families with or having children with disabilities; - orphans, children left without parental care; - repatriated Kazakh (oralman) status; - civil servants, servicemen, employees of special state bodies, employees of budgetary organizations; - invalids of 1, 2 groups.

At the same time, 50 percent of housing is sold to persons of the above categories, married for at least 3 years, with children (child), and the age of both spouses is under 35 (at the time of applying for participation in the Program), and also incomplete Families in which one of the parents, who has not reached the age of 35 years, including a divorced, widow, brings up the children (child).

Upon expiry of leasing period, housing passes into ownership of lessee; Leasing period with purchase option up to 20 years; Option of purchasing of leasehold housing; Guarantors’ attraction possibility in insufficient revenues.

The rental cost for 1 sq. m is 1,455 KZT (Almaty, Astana); 1 234 KZT (regions).

Announcements on the start of accepting applications for this program are posted on the sites of the LEA [23],[45],[46], [6]. After receiving documents from applicants for rental housing LEA a preliminary list of potential tenants is compiled and sent to the CFC to determine solvency. If potential tenants meet the requirements for solvency, KMC sends to LEA a list of potential tenants who meet the requirements for subsequent distribution and posts information on the CFC website (list of participants). The distribution of housing between the program participants will be carried out in an automated mode on the Company’s website, where program participants independently select housing (apartments) [42].

4.1.7 Mortgage "Orda" from JSC "MO" Kazakhstan Mortgage Company"

The mortgage "Орда" (Orda) - is a mortgage product of "MO "Kazakhstan Mortgage Company" JSC for lending to individuals for the purchase of apartments in the primary and secondary market through agent banks [38].

Mortgage program "Орда" is aimed at improving the living conditions of individuals with incomes of an average or above average level, who want to purchase housing (primary or secondary) of a higher comfort class (housing price above 25 million tenge) at a rate lower than the average market, having savings in the form of free cash or the possibility of providing a solid deposit as an initial contribution [3].

The loan is provided up to 65 million KZT for a period of up to 20 years. Depending on the full / partial confirmation of income, it depends on the amount of the down payment. Reward Rate:

- with full confirmation of income - 13 percent per annum;
- with partial confirmation of income - 14 percent per annum.

Real estate is acquired in the primary or secondary housing market. The partner bank, on the basis of the documents provided, carries out an initial selection of participants and sends an application to the KMC to assess the creditworthiness of the applicant and make a decision on the issuance / refusal of a loan. Based on the results of the decision, the Bank enters into an agreement on behalf of the KMC and passes the registration procedure of the pledge to issue a loan.

Partner banks (program operators): Bank Center Credit JSC, Jysan bank JSC, Kassa Nova Bank JSC [52].

4.1.8 The "Military product" of House Construction Savings Bank of Kazakhstan

Housing payments are cash volumes differentiated by region and family composition, paid to employees of special state bodies and military personnel in the form of special cash support in cases provided for by the republican budget [63].

Employees of special State authorities and military personnel receiving payments have the opportunity to receive a loan from the HCSBK to purchase housing

on the primary or secondary housing market [62], including those provided under equity agreements, without waiting for accumulation on deposit. The down payment is from 15 percent to 50 percent, the interest rate on preliminary loans is from 6 to 8 percent, the loan term is up to 25 years [65].

In 2018, 1 996 loans were issued to military personnel. For them HCSBK developed a separate housing program. For its implementation, the Bank allocated 98 billion tenge from its own funds, of which 24 billion were allocated for refinancing loans taken earlier in other second-tier banks [4].

According to Article 101-3 of the Law of the Republic of Kazakhstan "On Housing Relations", those military personnel who have not had their own housing where they served in the last 5 years receive housing payments [63], [51].

HCSBK is the only bank in which special deposits have a special status and guarantee of inviolability. Housing payments are not subject to withdrawal to the budget, and they cannot be seized for other obligations of the owner of this account [63].

5. The results of the analysis of programs and housing allocation algorithms

To develop a mathematical model of Housing Programs, let us consider the results of research conducted in [21] and [29].

5.1 Assessing the effectiveness of the impact of government measures on housing affordability

It is very important to know the effectiveness of the impact of various government policies on housing affordability. The effect of using municipal rental housing substantially depends on the level of rental rates, and the government's work with construction organizations provides a much better effect than using the usual subsidy policy [21].

In world practice, to determine the level of housing affordability, a coefficient «housing price to income ratio» is used, however, it is calculated on the basis of median values of the cost of housing and annual household income. In 2006, Russia's average incomes exceeded median incomes by 1,3 times [18]. In large cities, this excess was even greater. So, in Moscow it amounted to more than 2,2 times. Obviously, in this case, the use of average values leads to an overestimation of housing affordability.

To assess the effectiveness of specific measures, the indicator of the share of families with incomes sufficient to purchase housing is used. Comparison of the indicator with its basic value (in the absence of government assistance measures)

allows us to determine the effectiveness of a particular measure. However, in general, the calculation of the housing affordability coefficient is based on average indicators of household income. The real level of housing affordability can be determined using information on the distribution of income [21].

The income distribution is usually well described by a log-normal law [18],[1]:

$$f(x) = \frac{1}{\sigma x\sqrt{2\pi}} e^{-\frac{(\ln x - a)^2}{2\sigma^2}}, \tag{5.1}$$

where $f(x)$ is the relative density for the value of a per capita income x; a is the logarithm of the mean income; σ^2 is the dispersion of the distribution.

These parameters are estimated by methods of mathematical statistics on the basis of statistical data on the distribution of income by population groups. Parameters are calculated in the following way:

$$\sigma^2 = \ln \sqrt{\frac{s_0^2}{(\overline{x})^2} + 1}, \tag{5.2}$$

$$a = \ln \overline{(x)} - \frac{1}{2} \ln \sqrt{\frac{s_0^2}{(\overline{x})^2} + 1} \tag{5.3}$$

where $\overline{x}$ is the average income; s_0^2 is the variance of population incomes [21].

Let y_{min} be the minimum level of monthly income that a household needs to purchase housing using its own and borrowed funds, then all households whose income is above this value are able to purchase housing.

The share of such households (N) is determined from the ratio:

$$N = \int_{y_{min}}^{\infty} f(x)dx. \tag{5.4}$$

5.2 Market model and description of competitive equilibrium

An empirical approach to the formation of housing programs does not guarantee the appropriate and rational use of budget funds.

Next, we consider the approach to the appropriate development of local housing programs, which, without claiming to be universal, can be useful in many

cases.

It is assumed that the local administration initiates the development of a housing program or housing subsidies with fixed goals, terms and resources. The program developer (Regulator) must first of all choose a method for evaluating program options according to the degree to which program goals are achieved. It is natural to assume that the draft program should be evaluated by the properties of the equilibrium that would have arisen in the event of the implementation of this project.

Housing program formation. For an arbitrary market situation B, we introduce the following notation: I (B) - the set (numbers) of types of dwellings; supplier groups, respectively; GC (B) and GS (B) - sets (numbers) of consumer and

$g_{hi}(B)$ is the number of (i,h) agents;

$U(B) = \{(i,j,h) \in I^2(B) \times GC(B) | (g_{hi}(B) \neq 0)\}$ - the set of all possible consumer movements;

$d_i(B)$ is the number of dwellings of type i;

$d(B) = (d_i(B))_{i \in I(B)}$; $a(B) = (a_{ijh})_{(i,j,h) \in U(B)}$; $b(B) = (b_{ijh})_{(i,j,h) \in U(B)}$;

D(B;h) sets of dwellings acceptable to consumers of group h;

$W(B) = \{(i,j,h) \in U(B) | j \in D(B;h)\}$ is the set of acceptable consumer movements.

The linear programming task for market situation B is denoted by $ATC(B)$:

$$\sum_{nk} \sum_{h \in GC} b_{nkh} X_{nkh} \to max \tag{5.5}$$

and $ATC^*(B)$:

$$[\sum_{h \in GC} \sum_{n} g_{hn} \gamma_{hn} + \sum_{k} d_k \pi_k] \to min, \tag{5.6}$$

respectively.

Suppose that before the beginning of the period under review, the Regulator predicts the market situation A at the beginning of the period and determines the forecast balance. In this equilibrium, some consumers occupy socially unacceptable dwellings (too poor, too expensive compared to income, located in disadvantaged areas, etc.). It is necessary to change the initial situation so that the resulting equilibrium is as free as possible from these shortcomings [29].

Consider only the movement of consumers. Only two groups of ATC (A) task parameters are partially manageable. These are the components of the vectors d (A) and b (A). It is clear that by increasing $d_i(A)$ (the number of dwellings of type i), it is possible to influence the market from the supply side.

Let g be a (i, h) -consumer and k be a dwelling of type j. Then $a_{ijh} = \psi_{gk} = b_{gk} - q_{gk}$; in addition, $b_{ijh} = a_{ijh}$ if dwellings of type j belong to consumers, and $b_{ijh} = a_{ijh} - a_{0jm}$ if the dwellings of type j belong to the suppliers of the group m.

If you give consumer g a subsidy in the amount of σ due to relocation to type j housing, or benefits in the amount of σ for fixed payments for such dwellings, then the net utility of type j dwellings for this consumer will increase by σ (due to an increase in the starting price for type j dwellings first case, and lower fixed costs - in the second).

Therefore, by changing the components of the vector b (A), one can influence the market from the demand side.

Assume that the costs of market regulation are limited to K. The task of the Regulator is to develop a housing program (to distribute the amount of K between types of dwellings) or housing subsidies (to distribute the amount of K between market agents). Every regulatory program creates a new market situation. The purpose of the Regulator is to choose a program of one of the indicated types so that the number of consumers occupying acceptable homes in equilibrium for the new situation is maximum.

But before changing the initial situation A by regulatory influences, it is desirable to evaluate how much the regulatory goal in equilibria for this situation is achieved. Let us formulate the problem more broadly: how to assess the degree to which the goal of regulation is achieved in an arbitrary market situation B.

Let $f^B(\cdot)$ and $h^B(\cdot,\cdot)$ be objective functions 5.5 and 5.6, f_0^B is the optimal value of the objective function in the problems $ATC(B)$ and $ATC^*(B)$. Introduce a vector of variables $x = (x_{ijh})_{(i,j,h)\in U(B)}$. Let MA(B) and MI(B) denote the maximization and minimization problems, respectively, of the following functions:

$$\sum_{(i,j,h)\in W(B)} x_{ijh} \tag{5.7}$$

under conditions:

$$\sum_{i,h} x_{ijh} \leqslant d_j(B) \tag{5.8}$$

$$\sum_{j} x_{ijh} = g_{hi}(B) \tag{5.9}$$

$$f^B(x) \geqslant f_0^B, x \geqslant 0. \tag{5.10}$$

MA(B) and MI(B) are linear programming problems on a polyhedron defined by conditions 5.8 - 5.10.

This polyhedron is the optimal facet of the $ATC(B)$ polyhedron. Therefore, any basic admissible solution to the system of inequalities 5.8 - 5.10 is a basic optimal solution to the problem ATC(B), defines the equilibrium distribution for situation B, and, together with the solution to the problem $ATC^*(B)$, determines the standard equilibrium for situation B.

Function 5.7 describes the number of consumers occupying acceptable dwellings in the location described by vector x. Let $x^M(B)$ and $x^m(B)$ be optimal basis solutions to problems MA(B) and MI(B), respectively. Taking into account the previous argument, these vectors set the standard equilibrium $e^M(B)$ and $e^m(B)$ for situation B, in which the number of consumers occupying acceptable dwellings is maximum and, accordingly, minimum. The optimal values of function 5.7 in tasks MA(B) and MI(B) determine the boundaries for achieving the goal of regulation in standard equilibrium for situation B and, therefore, allow the Regulator to evaluate this situation. If there is a draft housing program, in the event of the implementation of which a market situation B arises, then, assessing situation B in the above way, we will evaluate the draft program.

Considering the forecast situation A as situation B, we can find out how much market regulation is necessary. If the equilibrium $e^m(A)$ is acceptable (from the point of view of the Regulator), then regulation is not necessary at all. If $e^m(A)$ is unacceptable, but there is an acceptable equilibrium - for example, $e^M(A)$ - then there is a fundamental possibility to push the market to this equilibrium without changing the initial situation. If the equilibrium $e^M(A)$ is unsatisfactory, then a short-term regulatory impact on the market may be useful [29].

Let R be the set of all pairs (i,h) such that $h \in GC(A)$ and some (i,h) consumers in the forecast equilibrium e^0 occupy socially unacceptable dwellings.

If $(i, h) \in R$, then we say that G(h,i) is a recipient subgroup of h.

Combining all the recipient subgroups, we get many recipient consumers, whose help is the goal of the program under development. As a rule, the housing program cannot cover all recipients; therefore, the Regulator allocates recipient subgroups for the project being designed; often plan and implement parallel regulatory programs targeting different recipient consumer subgroups.

Housing program. Suppose that local authorities intend to invest a certain amount in a housing program. What dwellings should be built under such a program?

Each software housing creates a chain of consumer movements; this chain is useful for achieving the goal of the Regulator if it involves moving the recipient to an acceptable home. A useful chain may include movements of other consumers as well, if these movements vacate homes acceptable to recipients. It is easy to find out what types of dwellings are acceptable for recipients by regulation; the construction of such dwellings should be included in the program. However, the construction of other types of dwellings may also be appropriate [29].

On the set of solutions of the system of inequalities 5.8 - 5.10, a function is determined.

$$\sum_{i,h \in R} \sum_{j \in D(B,h)} x_{ijh} \tag{5.11}$$

It describes the number of recipients occupying acceptable homes in a placement that corresponds to the vector x.

Consider the predicted situation A as situation B. By maximizing and minimizing function 5.11 under constraints 5.8 - 5.10, we find the basis optimal solutions x^1 and x^2 of the ATC(A) problem, which correspond to the equilibrium arrangements ζ^1 and ζ^2 for the situation A. Comparing ζ^1 and ζ^2, we find out (if, of course, these accommodations are different), for which dwellings the recipients compete with other market agents. It is advisable to build such dwellings. Moreover, estimates of constraints 5.8 in the problem of maximizing function 5.11 with constraints 5.8 - 5.10 indicate the relative usefulness of housing types to achieve the goal of the program.

However, this consideration, firstly, is valid only in the field of constancy of dual estimates, and secondly, does not indicate how many dwellings of each type should be built. Nevertheless, using the above considerations, you can make an

approximate list of types of dwellings that are advisable to include in the housing program. It should be noted that types of dwellings that are absent in situation A may be included in the program [29].

Firstly, it can be really new (structurally, in terms of location, etc.) types of dwellings. Secondly, with respect to the program housing, the Regulator plays the role of the supplier-owner, therefore all dwellings of the same type must belong to the suppliers (by definition of the same type of dwelling); therefore, if dwellings of type $i \in I(A)$ belong to consumers, then, including the construction of the same dwellings in the program, we must introduce a new type. Thirdly, if type i dwellings are owned by suppliers of group h, then the definition requires that the minimum selling prices $\psi_{g(k)k} = a_{0ih}$ be equal for all k type i dwellings; for the same program dwellings, the Regulator determines the minimum sale price, it can be less, equal to or more than the stream equivalent of construction costs (lowering the sale price is one of the forms of subsidizing consumers); if this price does not coincide with a_{0ih}, then a new type of housing must be introduced.

Finally, restrictions on consumer access to software dwellings are possible and often necessary; therefore, the rules for access to existing type i dwellings and the same program dwellings may vary, and in order to reflect this difference in the model, a new type of dwelling has to be introduced. With free access to software housing, the recipient may lose competition; and a competitive recipient may not get this home if the other consumer gets ahead of it. Therefore, it is possible that the program will provide housing for richer or more active consumers, and not for those (or not only those) for whom it is intended.

Hence, a natural restriction arises: only recipients have access to the dwellings built at the expense of the budget (which does not contradict the stimulation of the construction of dwellings intended for other consumers), and those to whom this dwelling provides a socially guaranteed minimum of housing consumption. However, more complex rules are possible; forming the housing program, the Regulator, naturally, defines the rules of access to program dwellings as an integral element of the program.

If we do not introduce the variable X_{ijh} in the ATC problem and indicate b_{ijh} as a small value, then we can reflect the ban on access of (i, h) consumers to dwellings of type j. Therefore, the ATC task describes standard equilibrium and with restrictions on the access of some agents (for example, the rich) to

some dwellings (for example, included in the social housing fund). In a market situation B, the Regulator can set the rules for access to dwellings by the set of permissible movements of consumers $V(B) \subseteq U(B)$: (i,h) consumers have access to dwellings of type j if and only if $(i, j, h) \in V(B)$; if there are no access restrictions, then V(B) = U(B). Assume that the vector of variables x describing the possible arrangement has the form $(x_{ijh})_{(i,J,h)\in V(B)}$. The above definition of the set W(B) of acceptable consumer movements should now be changed: W(B) $= \{(i, j, h) \in V(B) | j \in D(A; h)\}$.

Suppose that the types of program dwellings are defined in accordance with the requirements listed above, the program investments are somehow distributed between these types and, therefore, a draft program has been developed that determines how many dwellings of each type should be built, and rules for access to these dwellings. Let IP be the set of types of dwellings whose construction is included in the draft program (program types). Describe the project of the program by the vector $\Delta = (\delta_i)_{i\in IP}$, where δ_i is the number of dwellings of type i included in the project. If the project is implemented, a new market situation B will appear at the beginning of the period under review.

It is clear that $I(B) = I(A) \cup IP$, $GC(B) = GC(A)$; $d_i(B) = d_i(A) + \delta_i$ for $i \in I(A)$, otherwise $g_{hi}(B) = 0$ (since program dwellings are free at the beginning of the period). Therefore, U(B) $= \{(i, j, h) \in I(A) \times I(B) \times GC(A) | g_{hi}(A) \neq 0\}$. Assume that the b_{ijh} values for all $(i, j, h) \in I(A) \times I(B) \times GC$ and the a_{ijh} values for all $(i, j, h) \in U(B)$ are known. Let ψ for $i \in IP$ be the minimum commensurate price of type i dwellings set by the Regulator. $b_{ijh} = a_{ijh} - \psi_j$ is assumed for all $(i, j, h) \in V(B)$ such that $j \in IP$. Note that for ψ for $i \in I(A) \cap IP$, type i dwellings in situation A belong to the suppliers of some group h, and the value of ψ_i must be equal to a_{0ih} by the definition of the group.

Now all parameters of the ATC(B) task are defined. Solving it, we can construct the tasks MI(B) and MA(B). The optimal values of the objective function in these tasks indicate the range of changes in the number of consumers occupying acceptable dwellings in standard equilibrium for situation B, which is naturally considered the main indicator in evaluating the draft program.

Determine the boundaries for the number of recipients occupying acceptable dwellings in standard equilibrium for situation B, minimizing and maximizing function 5.11 under constraints 5.8 - 5.10. These indicators, however, to a lesser

extent characterize the feasibility of the project in question: for example, function 5.11 increases if recipients displace other consumers in unacceptable dwellings.

Another important characteristic of the draft housing program is the profit (possibly negative) made by the Regulator. To describe it, suppose that the Regulator agrees to sell (rent) software dwellings at any non-negative, commensurate price that consumers are willing to pay:

$$\psi_i = 0, i \in IP \tag{5.12}$$

In this case, the price of software housing is determined only by competition between consumers. Let C be the market situation obtained by imposing condition 5.12 on situation B, c_i the budget costs associated with the construction of a house of type $i \in IP$.

If (γ, π) is the optimal solution to the $ATC^*(C)$ problem, then in case of implementation of the draft program under review, the Regulator will receive reduced profit

$$R(\delta, \pi) = \sum_{i \in IP} \pi_i \delta_i - \rho \cdot \sum_{i \in IP} c_i \delta_i \tag{5.13}$$

For $R(\delta, \pi) > 0$, the project program is potentially profitable, and for $R(\delta, \pi) < 0$ it is potentially costly, so the range of variation of $R(\delta, \pi)$ depending on π is important.

$$\sum_{i \in IP} \pi_i \delta_i \tag{5.14}$$

under the limitations of the $ATC^*(C)$ problem

$$\delta_{h,i} + \pi_j \geq b_{b,i,j}, (i, j, h) \in V(B), \pi \geq 0, \tag{5.15}$$

and with the additional condition

$$h^C(\delta, \pi) \leq f_0^C. \tag{5.16}$$

Indeed, constraints 5.15 coincide with the constraints of the $ATC^*(C)$ problem. Condition 5.16 ensures that any feasible solution to the above optimization problems is an optimal solution to the $ATC^*(C)$ problem. Therefore, optimal solutions to these problems determine the prices of standard equilibrium for situation C, and from the corresponding values of function 5.14 it is easy to calculate the

boundaries of the change in $R(\delta, \pi)$ in standard equilibrium for this situation.

Thus, by varying the components of the vector Δ and evaluating the emerging options, we can choose a rational housing program.

If the market is experiencing a strong pressure of newcomers who have money, but do not have housing in this market (for example, migrants), then it is very likely that the maximum total usefulness will be provided by the construction of relatively expensive homes for this category of consumers. At the same time, local residents with unacceptably low levels of housing consumption will not receive either programmatic dwellings (due to high prices) or free housing (due to lack thereof). In the short term, this will lead to higher prices for all types of dwellings. In the medium term, a relatively autonomous segment of the housing market will be formed, supplying expensive homes to beginners.

The regulator can initiate profitable housing construction programs for wealthy (0,h) consumers (newcomers to the market), but it should limit the access of such consumers to dwellings being built as part of non-profit programs. On the other hand, the construction of dwellings intended for consumers who are not among the recipients and who have housing in the market in question can increase the income from the program and do not necessarily contradict its objectives, since recipients can occupy vacant dwellings. However, it is unlikely that access to such housing will be regulated if it does not belong to the municipal housing fund. These effects can be measured in case of variant calculations. In any case, the program developer must have an idea of which consumer groups the dwellings of each program type are intended for, and accordingly form access rules.

5.3 The mathematical model of housing in the Republic of Kazakhstan

This chapter describes a mathematical model for acquisition housing. The mathematical model is presented in section of steps.

The results of a comparative analysis of the basic requirements and conditions for obtaining housing are presented in table form (Appendix A).

Compiled a basic list of requirements for the purchase of housing (Appendix B). In the table, the basic requirements for housing are indicated by the letters $(A, B, C, D, \ldots, U)$ and the permissible values of the parameters are indicated.

Using this table and all the conditions for obtaining housing for each program, we will construct a mathematical model.

Several options for housing programs are considered and a mathematical model is constructed. The mathematical model will serve for housing acquisition estimates for a specific program depending on the time and stages of the program according to requirements. A separate mathematical model has been compiled for each program. Because each program has corresponding requirements.

According to clause 7 of Chapter 2 of the "Rules for the provision of banking services and consideration by banks, organizations engaged in certain types of banking operations, customer appeals arising in the process of providing banking services" approved by the Resolution of the National Bank of the Republic of Kazakhstan dated July 28, 2017 No. 136, the bank must provide the client information on rates and tariffs, the timing of the decision on the application for the provision of banking services. In this regard, second-tier banks on the Internet resource posted documents containing the general conditions for the operation, which indicate the deadlines for the provision of services.

In addition, local executive bodies on Internet resources post information on the need to provide documents for housing under various programs. These sites indicate all the conditions and terms for submitting documents, indicate the necessary time for calculating points, lists of people on the waiting list who received housing as part of the Nurly Zher Housing Program through the Housing Construction Savings Bank of Kazakhstan, through the Kazakhstan Mortgage Company.

To get housing, a program participant goes through several stages (steps), fulfilling certain requirements.

It takes time to fulfill the requirement and move on to the next step. For this, having studied the following materials, an infographic with time has been compiled: [72],[11],[45],[44],[52],[53],[46],[6],[51],[62],[65].

Using info-graphics, a separate table was compiled indicating the possible options for the time spent. (Table 5.1).

The purchase of housing under the program consists of several processes - $\boldsymbol{P}$ and $\boldsymbol{P_i}$ - subprocesses. To calculate the time taken to complete one stage, the time taken to collect documents or fulfill other requirements is taken into account. The total time $\boldsymbol{X(t)}$ spent on acquiring housing can be calculated by summing

Time			
Δt_1	1 day	Δt_9	1-5 days
Δt_2	1-2 days	Δt_{10}	7 days
Δt_3	1-15 days	Δt_{11}	10 days
Δt_4	2 day	Δt_{12}	15 days
Δt_5	1-3 days	Δt_{13}	30 days
Δt_6	3 day	Δt_{14}	1-6 month
Δt_7	3-15 days	Δt_{15}	0-36 month
Δt_8	5 days	Δt_{16}	weekends, holidays

Figure 5.1: Stage Time

up the time spent on going through all the sub-processes.

Next, a mathematical model is constructed for the following programs: the rental housing without redemption, the mortgage lending program “Бақытты отбасы”, the social housing of Local Executive Authorities (Akimats), the program "7-20-25", the market program "Баспана Хит", the rent-to-own basis housing through the Kazakhstan Mortgage Company (KMC), the mortgage "Орда" from KMC, housing for military service persons and employees of special government agencies through HCSBK.

5.3.1 Mathematical model for describing processes and steps by the program “Bakytty otbasy”

$X(t) = \sum P_i(t) = P_1 + P_2 + P_3 + P_4$ full time calculation.

According to the infographic (Appendix C, Figure C.2) the main stages of the program “Бақытты отбасы” (Bakytty otbasy) are divided into 4 processes. To obtain housing under this program, applicants must confirm the status of the needy and receive a referral for the Bank (P_1). The next stage is confirmation of solvency (P_2). The process of choosing a suitable home (P_3) and processing a loan (P_4) are followed.

P_1 - Family Status Confirmation Process: $P(t) = S + A_i(t) + + B_i(t) + C_i(t) + E_i(t) + F_i(t) + T_{p_1}$, i=1,. . . ,n

S - stage of obtaining an electronic digital signature (EDS);

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$T_{p_1} = \Delta t_1 + \Delta t_4 + \Delta t_8 + \Delta t_\varepsilon$ - time.

P_2 - Income verification process: $P_2(t) = P_1(t) + A_i(t) + B_i(t) + C_i(t) + +D_i(t) + E_i(t) + F_i(t) + G_i(t) + T_{p_2}$, i=1,. . . ,n

P_1 - referral to the HCSBK;

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_7 + \Delta t_\varepsilon$ - time.

P_3 - Housing search process: $P_3(t) = P_2(t) + J_i(t) + T_{p_3}$, i= 1,. . . ,n

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_3} = \Delta t_{14}$ - time.

P_4 - Loan issuing process: $P_4(t) = P_2(t)+H_i(t)+K_i(t)+L_i(t)+J_i(t)+T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_9 + \Delta t_\varepsilon$ - time.

5.3.2 Mathematical model for describing processes and steps by the program “7-20-25”

$X(t) = \sum P_i(t) = P_2 + P_3 + P_4$ full time calculation.

According to the infographic (Appendix C, Figure C.4), the main stages of the program “7-20-25” are divided into 3 processes. For this program, there is no need to go through the P_1 procedure, since there is no mandatory requirement. The process begins primarily with the search for housing, then goes into the process of confirming income.

***P_3* - Housing search process:** $P_3(t) = J_i(t) + T_{p_3}$, i= 1,. . . ,n

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_3} = \Delta t_3$ - time.

***P_2* - Income verification process:** $P_2(t) = M_i(t) + A_i(t) + C_(t) + D_i(t) + +G_i(t) + T_{p_2}$, i=1,. . . ,n

$M_i = \{m_i\}$, $(m_1, \ldots, m_n) \in M$ – the availability of other loans;

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_7 + \Delta t_\varepsilon$ - time.

***P_4* - Loan issuing process:** $P_4(t) = H_i(t) + K_i(t) + L_i(t) + J_i(t) + T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_9 + \Delta t_\varepsilon$ - time.

5.3.3 Mathematical model for describing processes and steps by the program “Social housing of Local Executive Authorities (Akimats)"

$X(t) = \sum P_i(t) = P_2 + P_4 + P_5$ full time calculation.

According to the infographics (Appendix C, Figure C.3), the main stages of the LEA program are divided into 3 processes. For this program, there is no need to go through the housing search procedure (P_3), as the Bank and the LEA themselves provide new housing. According to the terms of the program, housing purchased at the state's expense at low prices is purchased. The process begins primarily with the conclusion of an agreement on housing savings and the accumulation of a deposit to participate in the competition (P_5). Next is the process of confirming income (P_2) and issuing a loan (P_4).

***P_5* - Passing the competition in housing construction savings bank:** $P_5(t) = N_i(t) + H_i(t) + O_i(\Delta t) + T_{p_5}$, i=1,. . . ,n

$N_i = \{n_i\}$, $(n_1, \ldots, n_n) \in N$ – availability of housing savings in the bank;

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$O_i = \{o_i\}$, $(o_1, \ldots, o_n) \in O$ – the accumulation period;

$T_{p_5} = 2\Delta t_1 + \Delta t_9 + \Delta t_{15}$ - time.

P_2 - Income verification process: $P_2(t) = A_i(t) + B_i(t) + C_(t) + D_i(t) + +E_i(t) + F_i(t) + G_i(t) + R + T_{p_2}$, i=1,. . . ,n

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

R - the distribution of housing;

$T_{p_2} = \Delta t_7 + \Delta t_9 + \Delta t_\varepsilon$ - time.

P_4 - Loan issuing process: $P_4(t) = P_2(t)+H_i(t)+K_i(t)+L_i(t)+J_i(t)+T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_\varepsilon$ - time.

5.3.4 Mathematical model for describing processes and steps by the program “Military product"

$X(t) = \sum P_i(t) = P_2 + P_3 + P_4 + P_6$ full time calculation.

According to the infographic (Appendix C, Figure C.8), the main stages of the “Эскери баспана” (Military product) program through the HCSBK are divided into 4 processes. In this program, the process begins with the opening of a special deposit in the Bank (P_6). Military personnel from the state receive housing payments. And every month, the organization transfers the amount of housing payments on deposit. Thus, the process of accumulating the down payment is going on. Next is the process of finding housing (P_3) and income verification (P_2).

At the end, a loan is issued (P_4).

P_6 - Accumulation of a special contribution in housing construction savings bank: $P_6(t) = U_i(t) + N_i(t) + H_i(t) + T_{p_6}$, i=1,. . . ,n

$N_i = \{n_i\}$, $(n_1, \ldots, n_n) \in N$ – availability of housing savings in the bank;

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – availability of housing savings in the bank;

$U_i = \{u_i\}$, $(u_1, \ldots, u_n) \in U$ – special deposit in the bank;

$T_{p_6} = \Delta t_1 + \Delta t_{15}$ - time.

P_3 - Housing search process: $P_3(t) = J_i(t) + T_{p_3}$, i= 1,. . . ,n

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_3} = \Delta t_3$ - time.

P_2 - Income verification process: $P_2(t) = A_i(t) + B_i(t) + C_(t) + D_i(t) + +E_i(t) + F_i(t) + G_i(t) + T_{p_2}$, i=1,. . . ,n

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_2 + \Delta t_9 + \Delta t_\varepsilon$ - time.

P_4 - Loan issuing process: $P_4(t) = P_2(t)+H_i(t)+K_i(t)+L_i(t)+J_i(t)+T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_\varepsilon$ - time.

5.3.5 Mathematical model for describing processes and steps by the moregage program “Orda”

$X(t) = \sum P_i(t) = P_2 + P_3 + P_4 + P_4$ full time calculation.

According to the infographic (Appendix C, Figure C.7), the main stages of the program “Орда” (Orda) are divided into 3 processes. In this program, the

process begins with an independent search for housing (P_3). After passing the confirmation of income (P_2) at partner banks, a loan is issued (P_4).

P_3 - Housing search process: $P_3(t) = J_i(t) + T_{p_3}$, i= 1,. . . ,n

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_3} = \Delta t_3$ - time.

P_2 - Income verification process: $P_2(t) = M_i(t) + A_i(t) + D_i(t) + G_i(t) + +T_{p_2}$, i=1,. . . ,n

$M_i = \{m_i\}$, $(m_1, \ldots, m_n) \in M$ – the availability of other loans;

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_1 + \Delta t_6 + \Delta t_\varepsilon$ - time.

P_4 - Loan issuing process: $P_4(t) = P_2(t)+H_i(t)+K_i(t)+L_i(t)+J_i(t)+T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_2$ - time.

5.3.6 Mathematical model for describing processes and steps by the program “Baspana Hit”

$X(t) = \sum P_i(t) = P_2 + P_3 + P_4 + P_4$ full time calculation.

According to the infographic (Appendix C, Figure C.5),the main stages of the “Баспана Хит” (Baspana Hit) program are divided into 3 processes. In this program, the process begins with an independent search for housing (P_3). Requirements After passing the confirmation of income (P_2) at partner banks, a loan is issued (P_4).

P_3 - Housing search process: $P_3(t) = J_i(t) + T_{p_3}$, i= 1,. . . ,n

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_3} = \Delta t_3$ - time.

P_2 - Income verification process: $P_2(t) = M_i(t) + A_i(t) + D_i(t) + G_i(t) + +T_{p_2}$, i=1,. . . ,n

$M_i = \{m_i\}$, $(m_1, \ldots, m_n) \in M$ – the availability of other loans;

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_1 + \Delta t_6 + \Delta t_\varepsilon$ - time.

P_4 - Loan issuing process: $P_4(t) = P_2(t)+H_i(t)+K_i(t)+L_i(t)+J_i(t)+T_{p_4}$, i=1,. . . ,n

$H_i = \{h_i\}$, $(h_1, \ldots, h_n) \in H$ – a down payment;

$K_i = \{k_i\}$, $(k_1, \ldots, k_n) \in K$ – real-estate appraisal;

$L_i = \{l_i\}$, $(l_1, \ldots, l_n) \in L$ – re-checking documents;

$J_i = \{j_i\}$, $(j_1, \ldots, j_n) \in J$ – year of construction of housing;

$T_{p_4} = 2\Delta t_5 + \Delta t_2$ - time.

5.3.7 Mathematical model for describing processes and steps by the program "Rental housing without redemption"

$X(t) = \sum P_i(t) = P_7 + P_8$ full time calculation.

According to the infographic (Appendix C, Figure C.1) the main stages of the program "The rental housing without redemption" are divided into 2 processes. To obtain rental housing, confirmation of the status of the needy is required (P_7). After determining the list of past points, a lease agreement is concluded (P_8).

P_7 - Submission of an application for status confirmation: $P_7(t) = S + A_i(t) + B_i(t) + C_(t) + D_i(t) + E_i(t) + F_i(t) + N_i(t) + T_{p_7}$, i= 1,. . . ,n

S - stage of obtaining an electronic digital signature (EDS);

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}$, $(d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$N_i = \{n_i\}$, $(n_1, \ldots, n_n) \in N$ – availability of housing savings in the bank;

$T_{p_7} = \Delta t_1 + \Delta t_4 + \Delta t_6 + \Delta t_\varepsilon$ - time.

P_8 - Conclusion of a lease: $P_8(t) = R + T_{p_8}$, i= 1,. . . ,n

R - the distribution of housing;

$T_{p_8} = \Delta t_7 + \Delta t_\varepsilon$ - time.

5.3.8 Mathematical model for describing processes and steps by the program “Rent-to-own basis housing"

$X(t) = \sum P_i(t) = P_2 + P_7 + P_8$ full time calculation.

According to the infographic (Appendix C, Figure C.6) the main stages of the program “The rent-to-own basis housing” are divided into 3 processes. Education and health workers confirm the status of the needy (P_7). Applicants with the highest score confirm solvency (P_2). After this, a rental contract is concluded (P_8).

***P_7* - Submission of an application for status confirmation:** $P_7(t) = S + A_i(t) + B_i(t) + C_(t) + D_i(t) + E_i(t) + F_i(t) + N_i(t) + T_{p_7}$, i= 1,. . . ,n

S - stage of obtaining an electronic digital signature (EDS);

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}$, $(d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$T_{p_7} = \Delta t_1 + \Delta t_4 + \Delta t_6 + \Delta t_\varepsilon$ - time.

***P_2* - Income verification process:** $P_2(t) = A_i(t) + B_i(t) + C_(t) + D_i(t) + +E_i(t) + F_i(t) + G_i(t) + T_{p_2}$, i=1,. . . ,n

$A_i = \{a_i\}$, $a_1, \ldots, a_n \in A$ - citizenship;

$B_i = \{b_i\}$, $(b_1, \ldots, b_n) \in B$ – family status;

$C_i = \{c_i\}$, $(c_1, \ldots, c_n) \in C$ – absence of housing;

$D_i = \{d_i\}, (d_1, \ldots, d_n) \in D$ – income level;

$E_i = \{e_i\}$, $(e_1, \ldots, e_n) \in E$ – registration;

$F_i = \{f_i\}$, $(f_1, \ldots, f_n) \in F$ – scope of activities;

$G_i = \{g_i\}$, $(g_1, \ldots, g_n) \in G$ - age;

$T_{p_2} = \Delta t_5 + \Delta t_\varepsilon$ - time.

***P_8* - Conclusion of a lease:** $P_8(t) = R + T_{p_8}$, i= 1,. . . ,n

R - the distribution of housing;

$T_{p_8} = \Delta t_7 + \Delta t_\varepsilon$ - time.

6. Conclusion

The work performed in the research process: 1. Outlined the basic requirements for each program for housing with the following symbols. $(A, B, C, D, \ldots, U)$; 2. Conducted a synthesis of the process of obtaining housing on the main steps and conducted an analysis of convergence, identity of processes and operations; 3. Classification and mathematical representation of processes (time period) and parameters (citizenship, income, marital status, registration, down payment, etc.); 4. A comparative analysis is carried out.

The first chapter is Introduction chapter. Where we describe in detail, the current situation in the housing market and the main problems faced by those in need of housing. Chapter 2 is Preliminaries. Here we briefly described the problem that needs to be solved.

In Chapter 3 analyzes data on the provision of housing for citizens of the Republic of Kazakhstan. The ratios between the number of new apartments put into operation by the number of newlyweds are calculated. As well as the ratio between the number of new apartments commissioned and demographic growth. And it was concluded that existing programs do not sufficiently satisfy housing needs. This chapter also discusses the experience of foreign countries. Especially the experience of Singapore, where 80% of the housing stock is public housing. Singaporeans transfer monthly up to 37% to their own account in a special fund, which goes including future retirement, insurance, and future expenses in the form of real estate acquisition or payment for education. Including 17% deducted by the employer, and 20% - the employee. Of these 37%, almost 23% go to the investment account, from which the Singaporean can use the money to buy a house or pay for education. For five years, the Singapore family has been saving up for their apartment, and during this period, it cannot resell it [14]. In addition, a family can only claim one apartment through such a mechanism. The analysis

of foreign experience is very important for the development of domestic housing programs, i.e. when developing new state programs for providing housing, it is necessary to take into account the experience of other countries, and also use mathematical models to calculate the effectiveness of this program.

In Chapter 4 discusses the main state housing programs in the Republic of Kazakhstan. All the conditions of state and market mortgage lending programs are described. Studying the housing market of the Republic, mortgage programs for the acquisition of housing and rental housing are highlighted. Different programs are defined depending on the level of income. For large family and low-income, there are programs with a low interest rate. For buyers with a high level of income, as well as those who are not eligible for soft loans, there are market-based mortgage programs. All types of programs are detailed in this chapter.

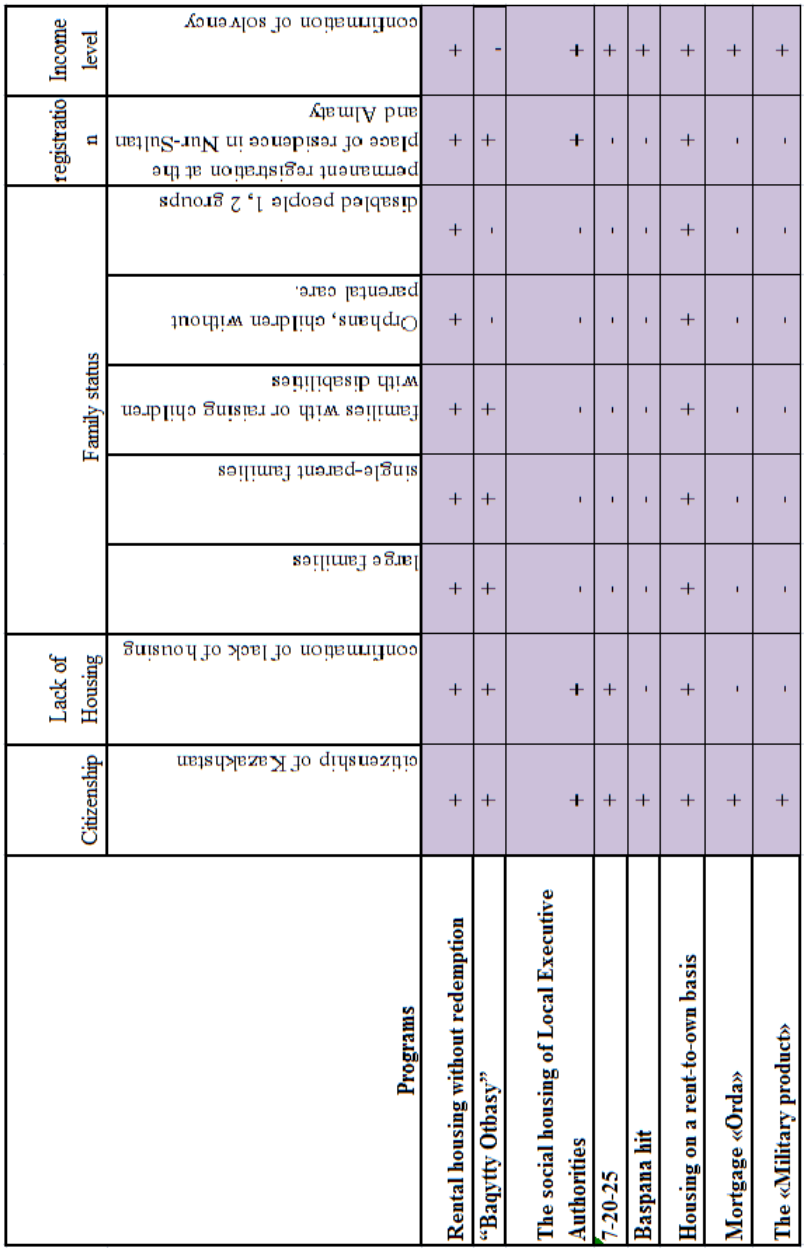
In the course of the analysis of housing acquisition programs, a housing infographic was constructed. In infographics, the main steps and the necessary time for passing the stages are clearly visible. Currently, there is no mechanism by which the applicant for housing could determine the appropriate type of housing program. Studying all the programs and all the requirements that must be met to obtain housing, we developed a mathematical model.

In chapter 5, we analyze methods for constructing a mathematical model. As a result, a mathematical model for the acquisition of housing was developed. A separate mathematical model has been developed for each type of program. Since each program has different requirements and steps. Program requirements (citizenship, family status, down payment, lack of real estate, registration, etc.) are the main parameters of the model. And the time spent on fulfilling the condition when moving from one stage to another stage is the main parameter of our mathematical model.

If, using the developed mathematical model, we write a program that will ask the user all of his parameters and compare it with the requirements of the mortgage program, then the applicant will easily determine the options for acquiring housing suitable for him. And this will serve to optimize the work of organizations that work in the direction of consulting clients on how to purchase housing. Thus, it is possible to remove the burden on contact centers, reduce the number of calls to bank branches and public service centers, i.e. front office work.

A. Appendix A

Figure A.1 and Figure A.2 are compiled for a visual comparison of the basic requirements for each program.



Programs	Citizenship	Lack of Housing	Family status						registration	Income level
	citizenship of Kazakhstan	confirmation of lack of housing	large families	single-parent families	families with or raising children with disabilities	Orphans, children without parental care.	disabled people 1, 2 groups		permanent registration at the place of residence in Nur-Sultan and Almaty	confirmation of solvency
Rental housing without redemption	+	+	+	+	+	+	+		+	+
"Baqytty Otbasy"	+	+	+	+	+	-	-		+	-
The social housing of Local Executive Authorities	+	+	-	-	-	-	-		+	+
7-20-25	+	+	-	-	-	-	-		-	+
Baspana hit	+	-	-	-	-	-	-		-	+
Housing on a rent-to-own basis	+	+	+	+	+	+	+		+	+
Mortgage «Orda»	+	-	-	-	-	-	-		-	+
The «Military product»	+	-	-	-	-	-	-		-	+

Figure A.1: Detailed consideration of the parameters

Programs	% rate	down payment	ding period,	Max. amount, tenge	Additional terms
“Baqytty Otbasy”	2%	10	20	15 000 000	primary or secondary housing market
Local Executive Authorities	5%	20	25	45 000 000	primary housing market
7-20-25	7%	20	25	25 000 000	primary housing market
Baspana hit	11,25%	20	15	25 000 000	secondary housing market
Mortgage «Orda»	13-14%*	от 30	20	65 000 000	secondary housing market
The «Military product»	8%	до 50	25	90 000 000	primary or secondary housing market

Figure A.2: The main conditions of mortgage programs

B. Appendix B

The basic requirements for housing can be seen in the following two tables.

	Requirements	Simbol	i =1..n	Possible options
1	Citizenship	A	1	Kazakhstan
			2	No citizenship
			3	Double citizenship
2	Family status	B	1	married
			2	single-parent family
			3	orphans
			4	disabled people 1, 2 groups
			5	large families
3	Absence of housing	C	1	There is housing
			2	No housing
4	Income level	D	1	up to 100 000 tg
			2	from 100 00 to 300 000 tg
			3	over 300 000 tg
5	Registration.	E	1	constant
			2	up to 2 years
			3	over 2 years
6	Scope of activities	F	1	individual entrepreneur
			2	state employee
			3	serviceman
			4	the sphere of education
			5	health care
			6	pensioner

Table B.1: Primary requirements

				continuation
	Requirements	**Simbol**	**i =1..n**	**Possible options**
7	Age	G	1	under 18 years old
			2	from 18 to 65 years old
			3	over 65
8	Down payment	H	1	10%
			2	20%
			3	30-50%
9	Year of construction of housing	J	1	New
			2	Up to 50 years
			3	Over 50 years old
10	Real-estate appraisal	K	1	Up to 10 million
			2	From 10 million - 40 million
			3	Over 40 million
11	Re-checking documents	L	1	Up to 5 days
			2	5-10 days
			3	15 and above
12	Availability of other loans	M	1	No loans
			2	Have loans
13	Availability of housing savings in the bank	N	1	There are accumulations
			2	No accumulation
14	The accumulation period	O	1	Up to 1 year
			2	1-3 years
			3	Over 3 years
15	Special deposit in the bank	U	1	There is a housing payment
			2	There is not have a housing payment

Table B.2: Primary requirements (continuation)

C. Appendix C

Infographics of housing by program, indicating the time and main stages see Figure C.1 - Figure C.8.

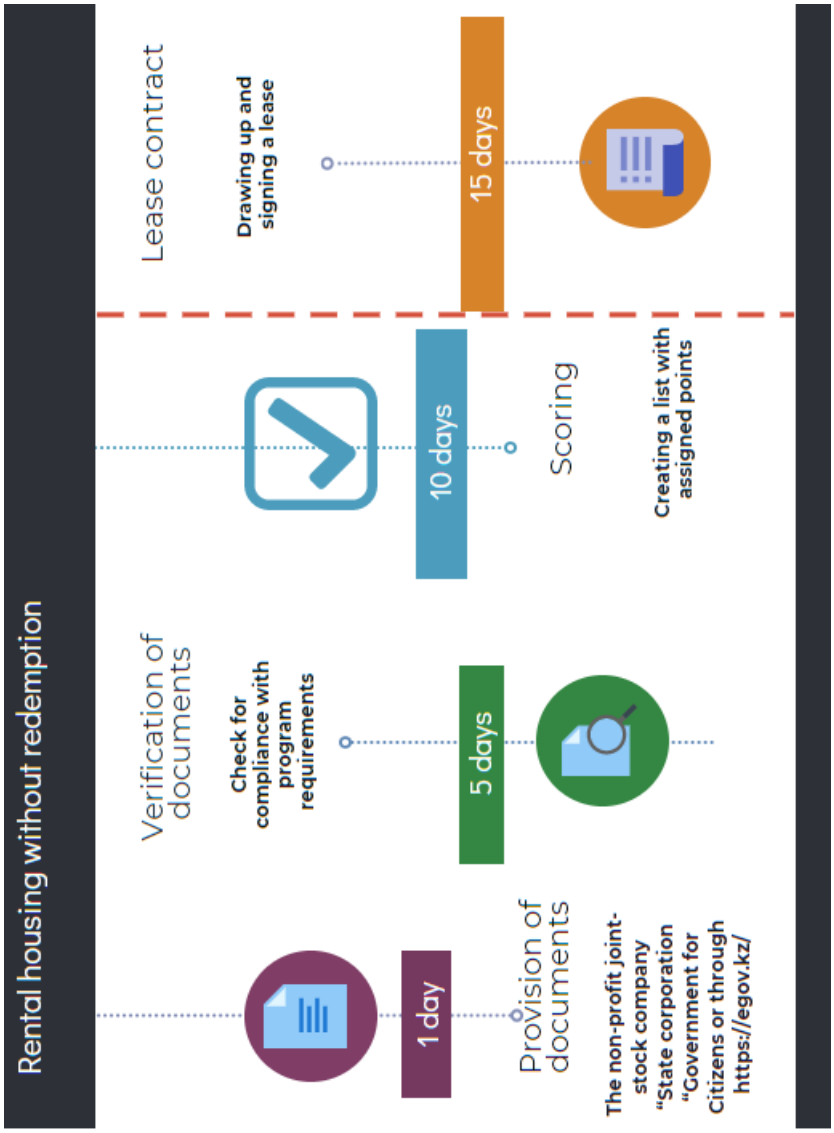


Figure C.1: The rental housing without redemption

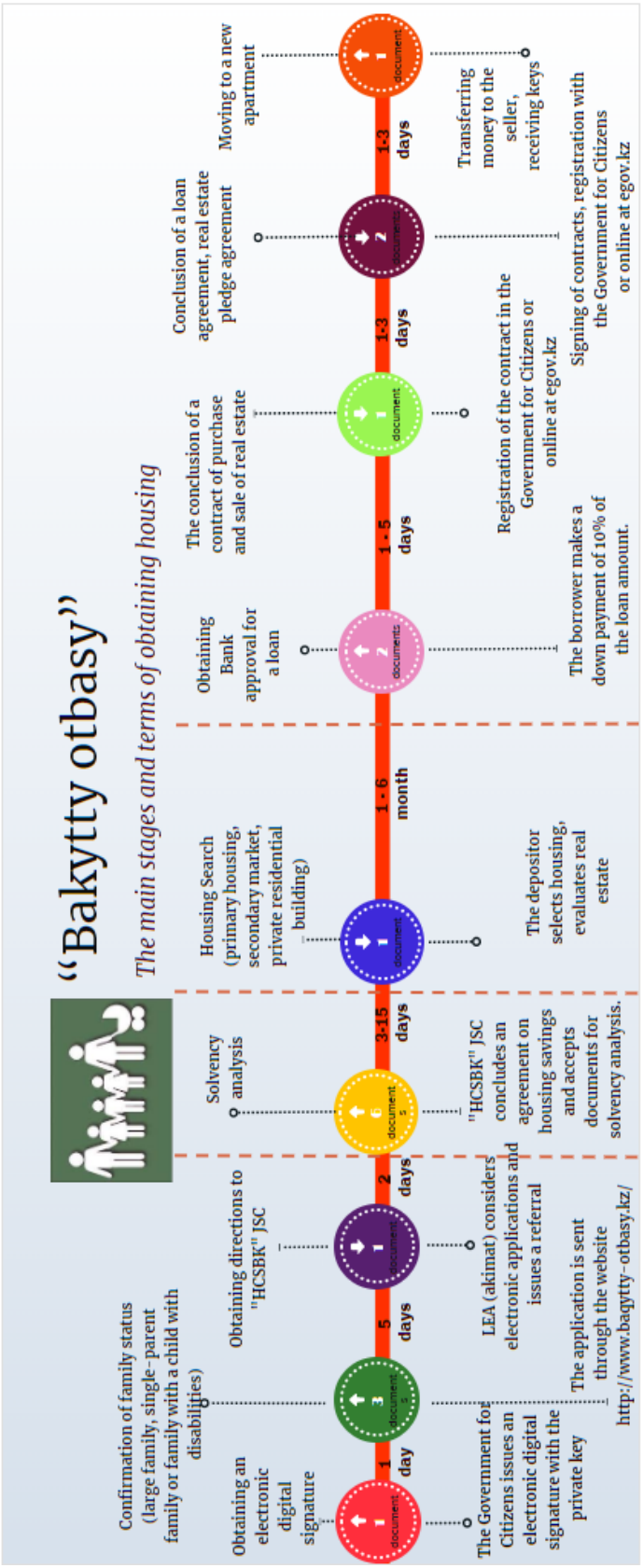


Figure C.2: The mortgage lending program “Бақытты отбасы” from "House Construction Savings Bank of Kazakhstan" JSC

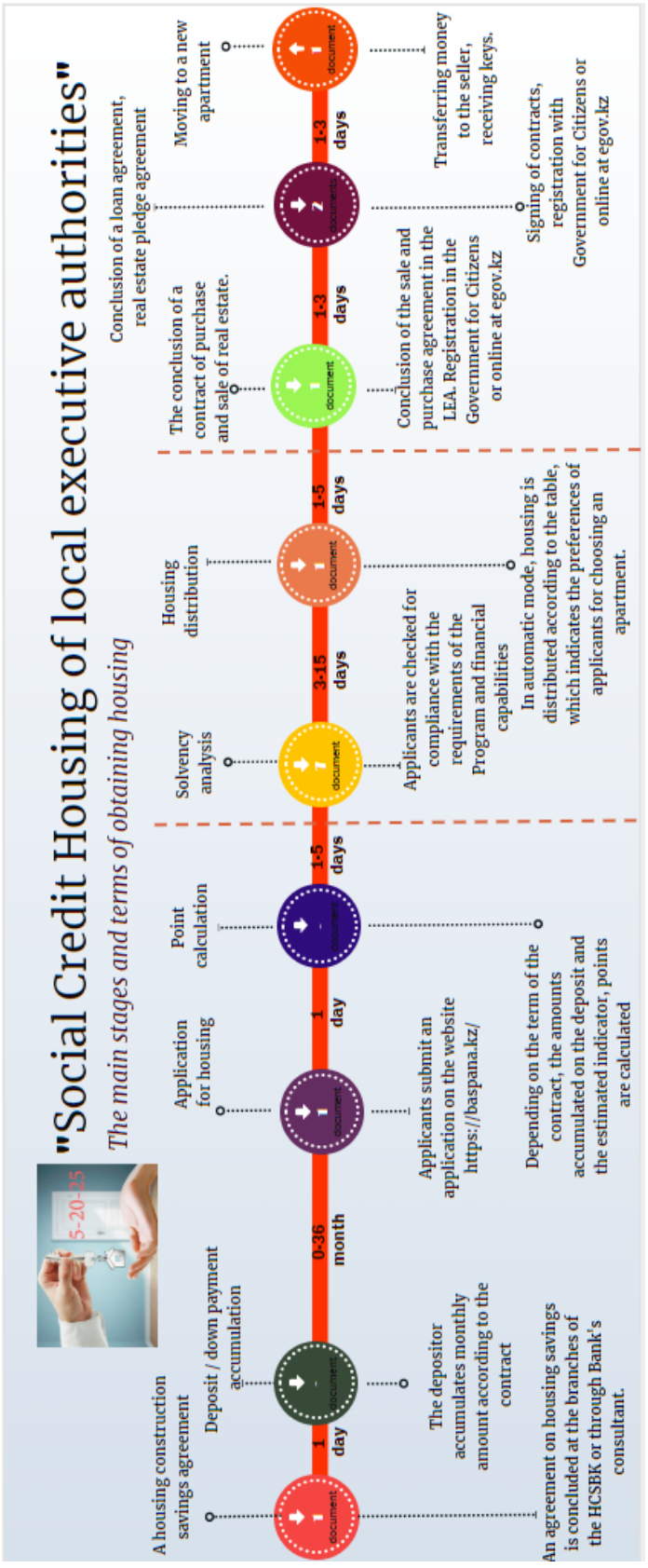


Figure C.3: Social Credit Housing of Local Executive Authorities

Figure C.4: The program "7-20-25"

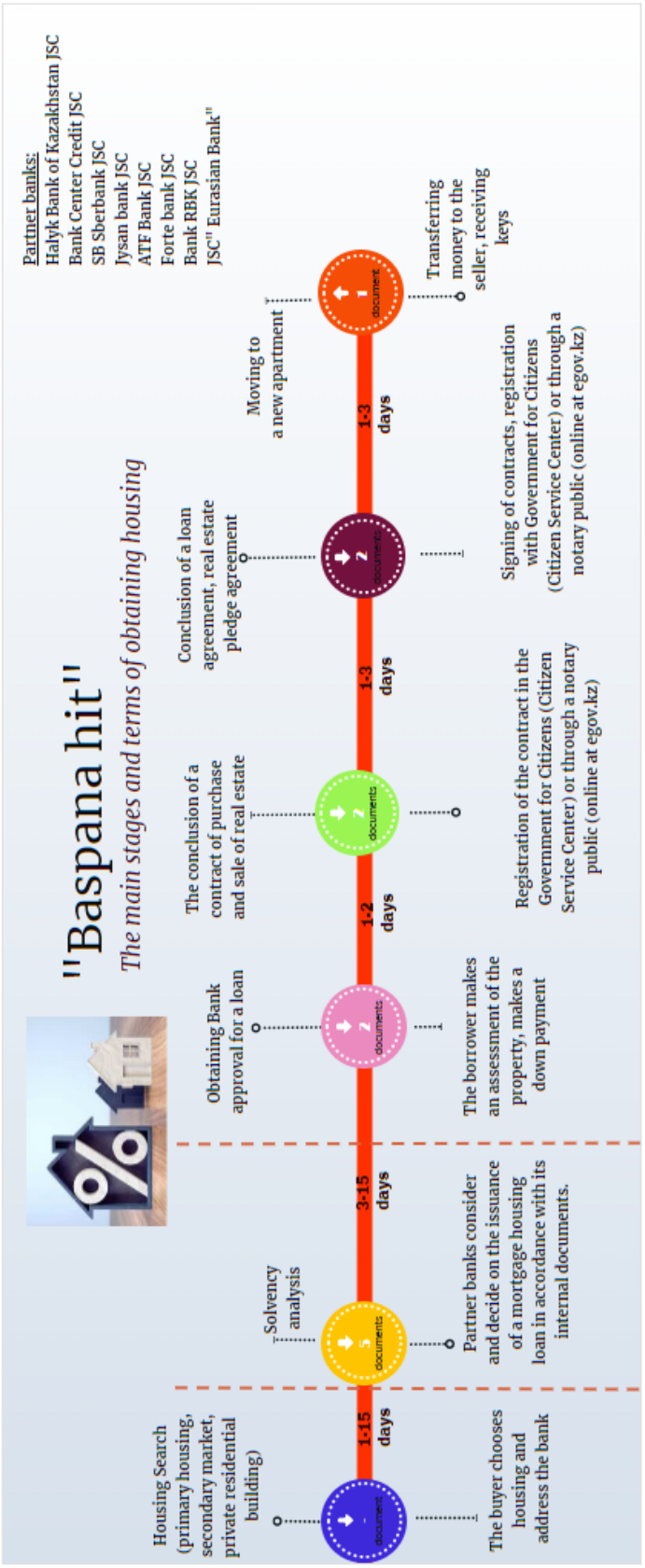


Figure C.5: The market program "Баспана Хит"

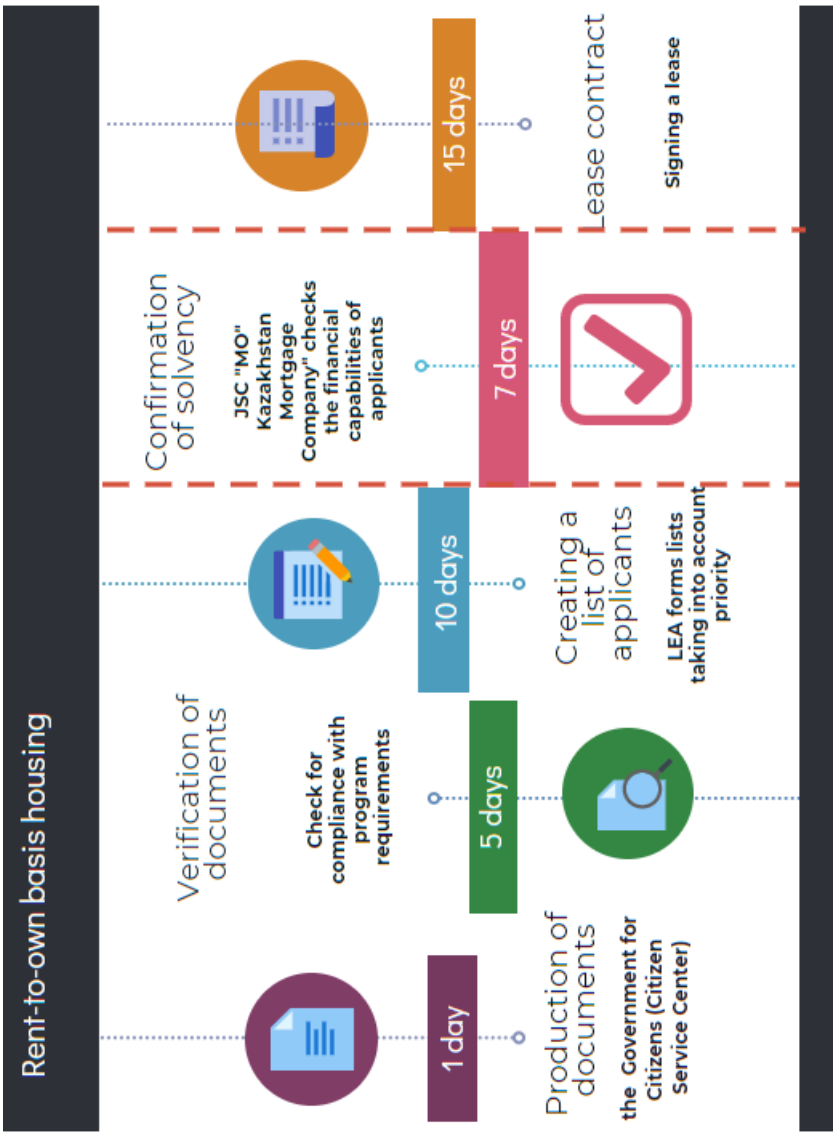


Figure C.6: Housing on a rent-to-own basis for education and healthcare workers of KMC

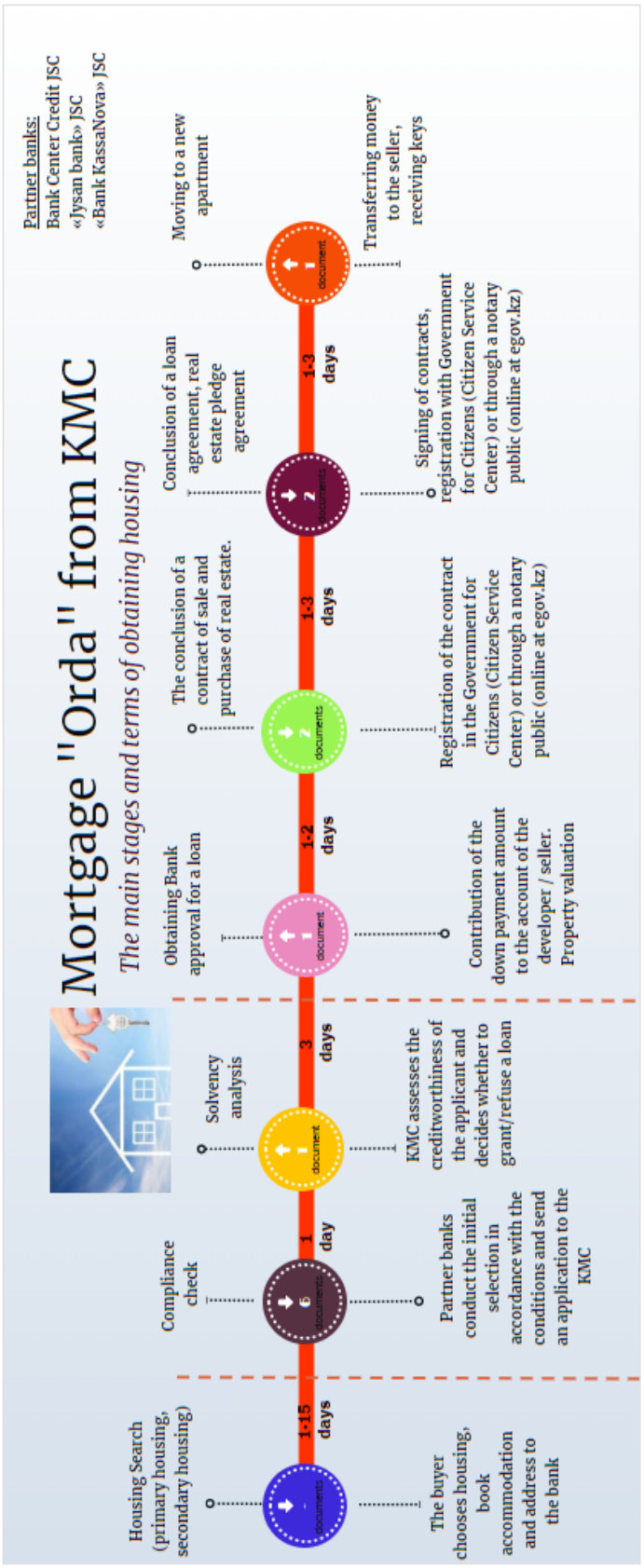


Figure C.7: The Mortgage "Орда" from KMC

Figure C.8: The "Әскери баспана" from HCSBK

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