

Analyzing the Relationship between Healthcare Facility and Housing Stock Volume: A Statistical Study of the International Association of the EAEU

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Abstract. This scientific article discusses the problematic development of the construction of priority medical facilities in the context of an active growth in the construction of new housing. It highlights the significance of hospitals and outpatient clinics as the central core for assessing the quality of life of the population, and how the construction of these medical institutions is crucial in the healthcare industry. Through the use of correlation analysis, the study reveals a significant disproportionality in the construction of medical institutions compared to the growing volume of new housing stock. The article raises important questions about the need to increase the volume of construction of social facilities and align them with the needs of the surrounding residents, while ensuring equal access for all citizens. Based on analytical calculations, the study draws certain conclusions and proposes specific recommendations within the framework of the Eurasian Economic Union (EAEU).

1 Introduction

In contemporary society, the quality of life of a population cannot be accurately evaluated without considering the quality of their healthcare. The healthcare industry's pace and number of social facilities under construction, including hospitals, clinics, pharmacies, and other medical institutions, are crucial indicators of the industry's quality. Additionally, the access to medical services plays a vital role in determining the health of the population. Access to medical services should not only be evaluated based on financial aspects, but also on the availability of medical facilities within a reasonable distance, such as within 20 minutes of walking or by transportation in urban areas and 35 minutes in non-urban areas.

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These norms are widely adopted in Russia and many member states of the Eurasian Union (EAEU) [1, 2].

The relevance of research. The research addresses the importance of the UN Resolution "Transforming the World. The 2030 Agenda for Sustainable Development" [3], which has been implemented since 2015 to improve the quality of life of the world community through 17 goals and 169 tasks. Of particular relevance is the eleventh goal aimed at improving cities and settlements. The successful realization of this goal requires a balanced approach to state housing and socio-demographic policy within individual member states of the Eurasian Economic Union (EAEU) as well as across the entire international association. The unified strategy of the EAEU plays a critical role in enhancing the quality of life for both EAEU citizens and the global community. However, an imbalanced policy in constructing social facilities and new housing can lead to social crises and tension, as it fails to meet the primary needs of EAEU member states, including access to decent and affordable housing and quality medical care, which are guaranteed by law [4].

The significance of identifying the correlation or lack thereof between housing construction and the construction of medical facilities in the EAEU lies in the exacerbation of their disproportionate development. The unbalanced pace of development between housing and hospitals can lead to unequal access to quality medical care among various income groups, which ultimately undermines efforts to improve the quality of life. The relevance of this study is further emphasized by its alignment with the international projects of the Council of the Eurasian Economic Commission (EEC) on ensuring the functioning of a single market for construction services and proposals for sustainable economic development [5-6]. The primary focus of this study, however, is on the formation of a balanced policy for the construction of residential and social facilities as an essential condition for achieving the Sustainable Development Goals.

Goals and objectives of the study. The current study aims to examine the disproportionate development of construction rates between residential facilities and medical institutions in the Eurasian Economic Union (EAEU) within the context of achieving Sustainable Development Goals. The objectives of this study include analyzing the individual dynamics of construction rates for new housing and medical facilities in the EAEU, investigating potential correlations between these dynamics, modeling and correlating changes in housing and hospital commissioning indices, and providing recommendations for the development of a balanced and unified housing and social policy for all EAEU member states.

Object and subject of research. The object of this research is housing and social policy within the concept of sustainable development of cities and towns, while the subject of the study is the dynamics of the rate of commissioning of housing and medical facilities in the EAEU region.

2 Literature review

The author proposes a comprehensive approach to studying the disproportionate development of healthcare facilities and housing stock construction, with a focus on the sustainability of the international association in the face of global challenges. This issue has been extensively researched in the international scientific community. Relevant works include those of G.W. Evans (2000) [7], M. Braubach, D.E. Jacobs, D. Ormandy (2013) [8], C. H. Mulder [9-11], and Yu Zhang, Haiyan Jin, Yue Xiao, and Yumin Gao [12]. These studies investigate the impact of the housing sector on the social and demographic behavior of the population, including health issues and the dynamics of family households' development.

Additionally, the works of Grabovoi P.G., Kapustkina A.V., and others [13-15] offer insights into developing the residential environment while considering environmental,

energy issues, and the advanced development of social and economic spheres of the residential environment. In the EAEU scientific field, opinions have been expressed that the development of the demographic and housing sectors influences the pace of social facility construction [16-21].

3 Materials and Methods

The methodology employed in this study is grounded on the systemic nature of the economies of EAEU member states, and utilizes the comparative method as well as general statistical modeling techniques. The authors have developed a methodological framework for systematic assessment of the relationship between various sectors of the construction industry, accompanied by specific recommendations aimed at improving the efficiency and sustainability of the construction industry in the EAEU. To process the data from 2005 to 2021 in the healthcare and housing sectors, the Correl statistical program was used. Additionally, the study drew on the experience of analyzing the convergence of the disproportionate development factors [22]. Consequently, the methodology of the present research is founded on generalized techniques of systematization and econometric analysis of statistics on the EAEU, in particular, utilizing the correlation method to examine the dynamics of the construction of residential and social facilities.

4 Results and Discussion

The quality of life of the population within the Eurasian Economic Union (EAEU) has been a subject of increasing research since the Union's inception. The multi-level development of the economies of its member states has highlighted the need for a unified housing and social policy throughout the international association. Specifically, this policy aims to establish a balanced ratio of residential and social facilities with medical importance across all participating States and the Union as a whole.

To understand the current state of the EAEU's development, it is useful to examine the gross domestic product (GDP) dynamics of its member states, specifically the construction and health and social services sectors, in terms of common current prices in millions of US dollars (see Table 1). These dynamics are predominantly represented by Russia, and their pace of development is disproportionate across the EAEU countries. The smallest share of the GDP for construction and healthcare in the EAEU is attributed to the Kyrgyz Republic.

Table 1. Gross domestic product for construction and healthcare (at current prices; US\$ million)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EAEU	construction	42530	56488	79677	108897	81909	103849	152802	164742	163737	146088	85386	99198	96732	97875	89246	97225
	health and social services	22087	30781	40613	52365	46814	53581	57876	60244	68736	67599	41480	50587	55716	58961	60453	63678
Armenia	construction	962	1511	2259	2951	1609	1604	1318	1247	1164	1079	818	838	823	865	873	903
	health and social services	120	161	227	313	300	298	372	371	427	447	430	479	540	627	683	934
Belarus	construction	2019	2738	3483	5185	4556	5337	4800	7523	8126	4337	2697	2876	3187	3708	3554	3479
	health and social services	973	1135	1393	1690	1386	1608	1452	1875	2130	2419	1660	1853	2118	2398	2426	2986
Kazakhstan	construction	4478	7941	9900	10795	9095	11405	12390	12847	14101	13159	8063	9132	9532	9958	10377	11189
	health and social services	977	1259	1741	1973	2067	2564	3288	3464	3794	3718	2598	3300	3402	3465	4370	5776
Kyrgyzstan	construction	66	76	136	270	314	265	305	429	464	555	570	661	746	839	775	679
	health and social services	50	64	80	108	121	122	180	224	229	211	185	197	207	216	215	241
Russia	construction	35005	44222	63899	89695	66335	85238	134824	145419	140485	123169	73238	85690	82444	82506	73667	80975
	health and social services	19967	28162	37172	48281	42940	48989	52584	54310	62156	60804	36609	44756	49449	52254	52760	53741

Source: compiled by the author based on EAEU statistics [23].

The demographics and construction industry of the Eurasian Economic Union (EAEU) member states exhibit disproportionate development, thereby necessitating the creation of a unified housing and social policy at the level of the international association. An analysis of demographic indicators reveals a positive trend in the growth of the population in the Kyrgyz Republic and the Republic of Kazakhstan, a moderate decline in Russia, and a severe decline in Armenia and Belarus. Overall, the EAEU demonstrates a slow growth in the number of citizens.

In contrast, the construction industry of the EAEU member states has shown an active dynamic, particularly in Russia, Kazakhstan, and Belarus, with Russia leading in the construction of housing and healthcare facilities. The volumes of construction products of housing and social facilities in these states dominate the EAEU's construction industry. However, Russia in the EAEU has a significant majority both in terms of population and in terms of construction of housing and healthcare facilities.

Urban planning and development of social infrastructure in the EAEU member states pose significant challenges due to the absence of consistent norms and regulations for the construction of medical and social facilities in new buildings. Despite the former common norms based on the number of inhabitants and distance, the current practice shows a lack of consideration of these indicators, resulting in a significant shortage of healthcare and social facilities in newly developed areas. This issue is further complicated by the legal inconsistency of norms regarding the registration of residents in new buildings, which hinders the construction of much-needed social facilities [24-27] The commissioning of new housing without proportional delivery of social infrastructure, including healthcare facilities, is a rising problem that exacerbates social inequality. To provide an overview of the trends in housing and hospital construction in the EAEU, Figure 1 displays the schedules for the commissioning of housing and hospitals from 2005 to 2021.

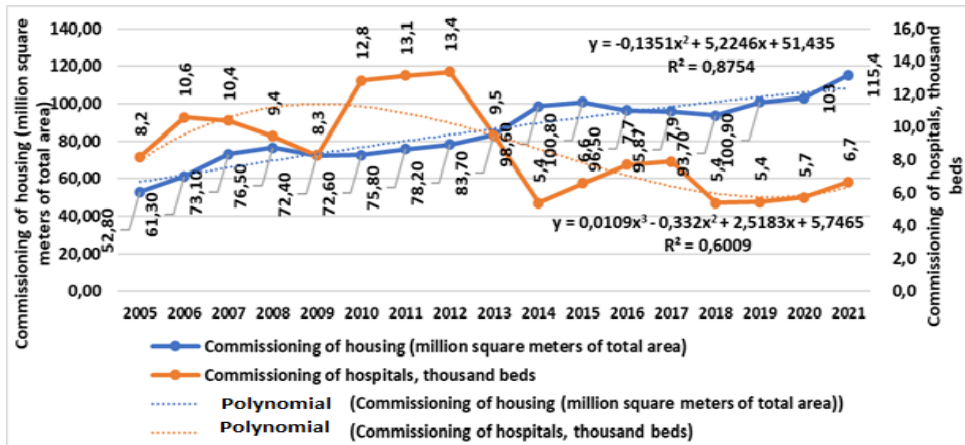


Fig. 1. Dynamics of commissioning of housing (million square meters of total area) and hospitals (thousand beds) across the EAEU

Source: compiled by the author based on EAEU statistics [23].

The data presented in Figure 1 indicates that the commissioning of hospitals in the EAEU is characterized by a chaotic trend with periods of active decline and rise. This is attributed to the lack of a unified and targeted system for monitoring hospital construction volume, both individually by states and within the EAEU. However, a relatively high commissioning volume of hospitals was observed during the period of decline in housing construction from 2010 to 2012. A complex cubic function of the trend line, $y = 0.0109x^3 - 0.332x^2 + 2.5183x + 5.7465$, with an average confidence factor of $R^2 = 0.6009$, confirms the chaotic nature of

hospital construction. The trend line since 2012 has been downward, indicating a future decline in hospital construction. In 2021, hospitals commissioned almost 3,000 fewer beds than in 2005, while the delivery of housing stock in 2021 was at a maximum relative to 2005. However, the housing stock showed a positive growth trend with an upward trend line throughout the EAEU's existence. Thus, hospital bed production does not correspond to the volume of new housing, leading to an overload of existing medical facilities and a decrease in the quality of medical services. A negative correlation coefficient of -0.64089025 between the commissioning of new housing and the volume of hospital beds implies a decrease in the volume of hospital beds with an increase in the housing stock and population. The disproportionate and unbalanced construction of two interdependent funds is evident, and the number of hospital beds produced is insufficient, leading to a decrease in access to medical care for the growing population. It is crucial to ensure a balanced and proportional delivery of healthcare facilities, including hospitals, to meet the needs of the population.

Below is a dynamic picture of the development of the same housing stock, but paired with the number of clinics built in the measure of 1,000 visits per shift (see Figure 2).

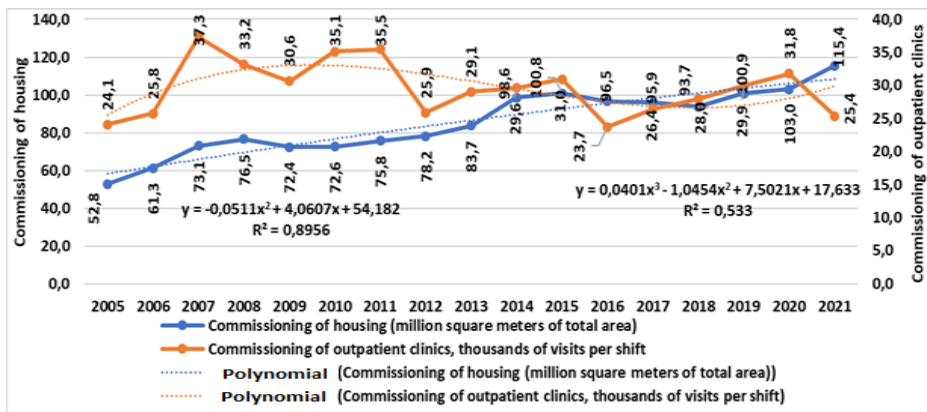


Fig. 2. Dynamics of commissioning of housing (million square meters of total area) and outpatient facilities (thousand visits per shift) across the EAEU
Source: compiled by the author based on EAEU statistics [23].

The graphic representation of the commissioning of outpatient clinics displays a different trend from the hospital commissioning, yet it is also not optimistic. The dynamics of the construction of outpatient clinics exhibit a chaotic development and lack dependence on the commissioning of housing. The maximum construction of polyclinics was in 2007, reaching 37.35 thousand visits per shift, while in 2021, only 25.4 thousand visits per shift were constructed, which is a low indicator considering the growing volume of housing commissioning. However, a closer examination reveals that since 2016, the number of polyclinics has been increasing following the trend of housing commissioning. The trendline exhibits a complex cubic function $y = 0.0401x^3 - 1.0454x^2 + 7.5021x + 17.633$ with a low confidence factor of $R^2 = 0.533$, corresponding to 53% accuracy. This low confidence factor may be attributed to a sharp drop in polyclinic construction in 2021. The predictability of future behavior is uncertain, but a growth trend is more probable than a decline. Nevertheless, the construction of polyclinics does not demonstrate any correlation with housing commissioning, indicating independent chaotic development. A correlation analysis confirms the absence of any relationship between the construction of outpatient facilities and the commissioning of new housing stock. The insufficient number of such institutions drastically increases the attendance of existing polyclinics, thereby increasing patient care time. The inaccessibility of polyclinics also exceeds the standard time of 20 minutes, rendering medical ambulance services unavailable and distant.

Thus, the construction of polyclinics is unrelated to the housing stock and the population size. The availability of construction of polyclinics is probably dependent on investment and financial attractiveness of residential development.

5 Conclusion

The present study concludes that the Eurasian Economic Union (EAEU) lacks a unified concept for constructing medical institutions in compliance with regulatory requirements for the number of residents in a certain radius of location. It is evident that constructing socially significant facilities is currently an unattractive and unprofitable endeavor. Majority of these facilities are not investment-attractive and have a prolonged pay-off period. Typically, developers initiate the construction of social facilities under administrative pressure, at their own expense, or after the completion of residential facilities, involving investor funds. Construction of medical institutions has high regulatory barriers concerning quality and requires numerous permits from various government agencies, leading to an imbalance between housing construction and social facilities. The cumbersome state financing system of socially-oriented projects adds to the burden of constructing social facilities. The centralized financing deprives local authorities of the design and financial maneuver for constructing medical institutions in favor of consumers of medical services. Hence, the state needs to attract private businesses for more flexible structures. The public-private partnership sector appears to be an attractive alternative for constructing socially significant facilities.

6 Recommendations

A unified housing and social strategy is required for the EAEU to develop their economies. To plan a social housing strategy, several factors must be taken into consideration. First, a unified assessment system should be established to monitor the construction of residential and social facilities in terms of both quality and quantity. Second, a mechanism or fundamental guidelines for the formation of a public-private partnership should be established to facilitate international cooperation. Third, the normative documents for proportionate construction of social facilities should be harmonized with those for residential construction, and compliance with existing residential buildings should be monitored. Fourth, the EAEU should stimulate the construction of social facilities alongside residential buildings. Fifth, existing public-private partnership programs in housing construction should be activated and stimulated with a view to orienting them towards the construction of social facilities. Finally, mechanisms for public control and information openness over the progress of construction of socially oriented facilities should be created.

The lack of dependence between the dynamics of the construction of residential funds and the construction of medical institutions underscores the need for active participation from science and the construction industry to minimize the damage from the disproportionate development of the construction volumes of these two significant objects. These studies should be considered within the framework of housing demography as a full-fledged and modern scientific direction.

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