

Vernacular Practices in the High Rises: Problems and Potentials of People Renovating the High-Rise Apartments in Ukraine

Andrii Shcherbyna

Department of Construction Economics,
Kyiv National University of Construction and Architecture, 03037, Kyiv,
Ukraine

Email: an.shcherbyna@ukr.net

Received	Accepted	Published
03.11.2023	25.01.2024	31.01.2024

<https://doi.org/10.61275/ISVSej-2024-11-01-19>

Abstract

There is a dire need to rejuvenate the aging housing stock of Ukraine, addressing the pressing need to upgrade residential buildings to better serve the needs of the people. It explores the multifaceted problems, requirements, and potential solutions for doing so, focusing particularly on the high-rise apartment blocks that form a significant part of the urban landscape.

Data collection involved a study of existing literature, analysis of recent legislation, financial records from various Ukrainian city councils, and comparisons with European housing renovation models.

The findings highlight an incomplete legal framework for enabling people to do them by themselves without professionals; in other words, vernacular or engaging investors as a major impediment to attracting investors for modernization projects. Despite recent legislative advancements aiming to address this, challenges such as complex decision-making processes and financial constraints persist. The research also uncovers the potential in adopting European models of housing renovation, focusing on energy efficiency and improved living conditions of the people. The potential for using modern technologies like Building Information Modeling (BIM) is also identified as a key driver for innovation in urban development.

In conclusion, the paper suggests that while there are significant challenges in renovating high-rise apartments in Ukraine, there are also substantial opportunities for transformative developments that could engage peoples own vernacular practices. Effective renovation strategies, tailored to the unique context of Ukraine and involving coordinated efforts among various stakeholders including the people themselves, are essential for achieving sustainable urban renewal and improved housing conditions.

Keywords: Housing stock assessment, Capital restoration of housing, Municipal infrastructure, Contemporary Vernacular, Apartments

Introduction

The housing stock of Ukraine is in a bad condition. The buildings require repairs and major restorations. According to La Greca and Margani (2018), communal infrastructure of Ukraine is inefficient and also requires repair. In fact, more than seventy per cent of the facilities are deteriorating. According to data provided by the state statistics service, as of January 1, 2020, there were about 50000 old and about 17000 dilapidated houses in Ukraine, both residential and non-residential. The vast majority of these three- to five-story buildings, prefabricated or brick, have been built in the post-war years in major cities up to and including the mid-1970s. Today, they have critical physical deterioration.

According to the state statistics service, as of January 1, 2021, almost 12% of the 200000 blocks of flats in Ukraine have been built in the period from 1919 to 1945, and every fourth in the period from 1946 to 1960. More than 67000 houses have been built between 1960 and 1980 (Marini *et al.*, 2017).

More than ten million Ukrainians live in the so-called “khrushchyovkas”. They are dormitories and small flats with limited comfort. Insufficient funds for proper maintenance, repair and renovation of such housing accelerates the rate of ageing and decommissioning of buildings as they approach a state of disrepair. The number of dilapidated residential buildings are growing with each year (Addanki and Venkataraman, 2017).

There are several ways to get rid of old dormitories and houses built during the Khrushchev era. They involve renovation, reconstruction, demolition, and modernisation. One of the ways is block reconstruction which involves the reconstruction of the entire block, rather than the houses (Rasulov *et al.*, 2023). Then, everything is built from the foundation, infrastructure. In this approach, roads, driveways, car parks, shops and public spaces such as kindergartens, squares, and schools have to be rebuilt (Ahvenniemi *et al.*, 2017). Although cumbersome, this approach may solve the problem for a long time to come. Meanwhile, the city and residents can save thousands of hryvnias on repairs and services. However, the concept has several significant drawbacks: high costs; long duration (repairs can take years); the issue of temporary accommodation for the residents of the area and the associated logistics (Büyüközkan and Karabulut, 2018).

Another option is to renovate the existing housing stock. The main problem there is the condition of the houses. Moreover, even “khrushchyovkas” can vary significantly from one another. Their current state depends on a number of factors. However, this concept also has limitations: it is not suitable for all households. That is because for an indefinite period, residents have to live in conditions of regular repairs with all the consequences, disconnection of road access due to traffic, dust, noise; shorter service life of the reconstructed buildings compared to the new ones (Kerimkhulle *et al.*, 2023). Experts believe that the renovation of dilapidated housing stock of Ukraine needs to be addressed urgently by updating the regulatory framework based on previous experiences.

Meanwhile, the state budget for 2007 has allocated UAH 250 million for the reconstruction of obsolete housing; the use of these funds has been approved by the government. From 2008 to 2013, it was planned to implement pilot projects of complex reconstruction in 12 cities: Vinnytsia, Dnipro, Donetsk, Kyiv, Lutsk, Mykolaiv, Poltava, Sumy, Kharkiv, Khmelnytskyi, Chernivtsi and Chernihiv (Order of the Ministry of Development of Communities, 2021). However, the law proves to be unviable: reconstruction only covers buildings up to five storeys, all work has to be carried out with developer funds, and 100% of the building's occupants have to agree to the reconstruction (Ahvenniemi *et al.*, 2017). Currently, infrastructure of Ukraine is suffering significant damage as a result of military aggression of Russia. In fact, as of the end of April, about 72000 buildings in Ukraine have been damaged or destroyed, 14000 of which are damaged beyond repair. It is estimated that it will take more than \$100 million and several years to repair all the damage (as of today). Therefore, today, this issue has become even more relevant (Khudiakov and Sukhonos, 2021).

In the face of deteriorating housing conditions across Ukraine, this paper aims to provide a clear roadmap for rejuvenating the nation's housing stock. The objectives of this research are threefold:

1. Develop a comprehensive methodology to assess the current state of housing.
2. Calculate the financial implications of renovation efforts.
3. Formulate a feasible timeline and schedule for renovation projects.

By achieving these objectives, the study supports state initiatives in effectively addressing the critical need for capital repairs, considering both the structural composition of the buildings and the logistical aspects of implementing such large-scale renovations.

Theoretical Framework: Vernacular Practices vs Professional Involvements

The theoretical framework for this study is grounded on contemporary vernacular practices, the concepts of urban renewal, sustainable development, and public policy. Central to this framework is the understanding of urban renewal as a multifaceted process that not only encompasses physical reconstruction but also aims to improve the social, economic, and environmental aspects of living spaces. Firstly, the concept of vernacular practices or people doing things by themselves to improve their living environments have been long recognised by theoreticians such as Habraken (1977) and Turner, (1956). They point out that people know better and can do better in transforming their housing environments by themselves, although professional support may be needed at some levels.

Urban renewal is often examined through the lens of revitalizing aging urban areas, and in so doing, the need to involve people and their contemporary vernacular have been acknowledged. This involves understanding the dynamics of urban decay and the factors contributing to the deterioration of housing stock, when people neglect their surroundings. Theories related to urban planning and architecture are employed to assess the practical aspects of renovating high-rise apartments, including considerations of spatial design, building materials, and construction technologies (Shtendera, 2021).

Sustainable development forms another crucial part of this framework. It focuses on renovation strategies that are environmentally responsible, economically viable, and socially equitable (Sun *et al.*, 2020). This includes energy-efficient building practices, use of sustainable materials, and designs that enhance the quality of life for the residents. The framework draws upon principles from environmental studies and green architecture, emphasizing the need for housing projects that align with broader environmental goals (Diatlova and Diatlova, 2021). Public policy theories provide insights into the role of government and legislation in urban renewal projects. This involves an exploration of housing policies, funding mechanisms, and regulatory frameworks that can either facilitate or hinder the renovation process. The study looks at how effective policy-making, including incentives for private investment and public-private partnerships, can drive large-scale urban renewal initiatives (Reznik *et al.*, 2022; Trusova *et al.*, 2018).

Finally, the theoretical framework integrates concepts from economics, particularly those related to the cost-benefit analysis of renovation projects. This includes understanding the financial implications for various stakeholders, evaluating the long-term economic benefits of renovation, and analyzing the impact of housing improvements on property values and urban economies (Serdiuk *et al.*, 2022). By weaving together these diverse theoretical perspectives, the study aims to provide a comprehensive understanding of the challenges and opportunities in rejuvenating Ukraine's housing stock, offering insights that are relevant not only for urban planners and policymakers but also for residents and investors (Troian *et al.*, 2024).

Review of Literature

In the quest to understand the complex landscape of renovating high-rise apartments in Ukraine, a comprehensive review of existing literature reveals a diverse range of studies, each contributing unique insights to this multifaceted issue. This literature review groups these studies into thematic categories, facilitating a

structured understanding of the various dimensions involved in the renovation process.

The first group focuses on business models and economic feasibility. Brown (2018) offers a critical assessment of residential retrofit business models in the UK, highlighting the shift towards more innovative approaches. Ciulla et al. (2016) provide an energy and economic analysis of retrofit actions in Italian historical buildings, emphasizing the significance of region-specific solutions. Similarly, Pardo-Bosch et al. (2019) delve into strategizing sustainable cities through building retrofitting, presenting models that involve municipal leadership and stakeholder engagement. The second category centers on holistic and integrated approaches to renovation. Marini et al. (2017) propose combining seismic retrofit with energy refurbishment for a sustainable renovation of reinforced concrete buildings. Zanni et al. (2019) introduce the concept of incremental integrated holistic rehabilitation, advocating for environmentally responsible renovation strategies.

Specific to the Ukrainian context, several studies form a third category. Troian et al. (2024) analyse the rehabilitation of aged pre-fabricated concrete buildings in Ukraine, focusing on CO2 emission reduction. Zanuda (2020) examines the current state of housing in Ukraine and potential revival strategies. Pleshkanovska and Biriuk (2021) discuss the challenges of complex reconstruction programs in Ukrainian cities, while Shevchenko (2020) provides practical proposals for the renovation of residential areas in Poltava. A fourth group addresses the administrative and structural aspects. Haran and Stepanova (2023) emphasize the role of social housing in urban planning, while Reznik et al. (2022) focus on the performance of housing structures in Kharkiv under the influence of combat actions. Serdiuk et al. (2022) explore thermomodernization as a means to extend the service life of obsolete housing. Horislavska (2019) analyses the possibility and methods of incorporating international experience in housing management into national legislation, considering its significance for the interests of all citizens in the context of recent reforms in the housing and communal sector in Ukraine.

This literature review underscores the multifarious aspects of renovating high-rise apartments in Ukraine, from economic models and holistic approaches to specific regional challenges and administrative strategies. However, a notable gap in the existing literature is the lack of a comprehensive study that integrates these various aspects within the unique socio-economic and political context of Ukraine. The current research aims to fill this gap by providing an all-encompassing analysis of the renovation needs, strategies, and potential impacts, specifically tailored to the Ukrainian scenario. This study endeavours to bridge the divide between theoretical insights and practical applications, offering actionable strategies for stakeholders involved in the renovation of Ukraine's aging high-rise apartments.

Research Methods

The research methodology employed in this study assesses the current state and potential strategies for renovating high-rise apartments in Ukraine. Data collection process was methodical and detailed, ensuring a robust and repeatable research framework. Initially, a thorough study of existing literature was conducted to establish a foundational understanding of the subject. This included academic papers, government reports, and case studies relevant to housing renovation and modernization in various contexts, with a particular focus on Ukraine. The research involved analysing specific case studies from the Ukrainian cities.

Detailed records of the housing renovation projects in cities such as Obukhiv, Netishyn, Rubizhne, Boryspil, Slovyansk, Uzhhorod, Kramatorsk, Bila Tserkva, Lutsk, Cherkasy, Khmelnytsky, Chernihiv, Lviv, and Zaporizhzhia were examined. This analysis provided practical examples of the implementation of renovation projects, including budget allocations, project timelines, and the scope of work. Financial and technical data were gathered from official documents and reports from local city councils and housing associations. This included

budget reports, renovation plans, and funding allocations for housing projects in the specified cities. Following publications on Ukrainian housing were examined.

1. The Law of Ukraine No. 525-V "On Comprehensive Reconstruction of Blocks of Buildings (Micro-districts) of the Outdated Residential Housing Stock" (2006): this determines the legal, economic, social and organisational principles of carrying out complex reconstruction of quarters (residential districts) with replacement of obsolete housing.
2. Law of Ukraine No. 525-V "On Comprehensive Reconstruction of Blocks of Buildings (Micro-districts) of the Outdated Residential Housing Stock" (2006) and the
3. Draft Law of Ukraine "On Amendments to the Law of Ukraine "On Comprehensive Reconstruction of Blocks of Buildings (Micro-districts) of the Outdated Residential Housing Stock"" (2021).

The document No 3 provide for the allocation of responsibilities between the state authorities and project owners. According to it, the sphere of responsibility of the public authorities include planning a comprehensive reconstruction of micro-blocks according to the zoning plan; development and approval of large-scale planning documentation; engineering training, creation of infrastructure and landscaping at the expense of public funds, local budgets, and private developers; conducting transparent investment tenders to find a developer.

A comparative analysis of international practices in housing renovation, focusing on countries with similar socio-economic conditions and housing challenges was also conducted. Finally, the data gathered from these diverse sources were meticulously compiled, analysed, and cross-referenced to ensure accuracy and comprehensiveness. The research methodology employed not only allowed for a detailed assessment of the current state of housing renovations in Ukraine but also provided a framework for evaluating the effectiveness of various strategies and approaches applied both in Ukraine and in other countries with similar challenges.

Findings

Investors willing to participate in projects to modernise existing flats are hindered by an incomplete legal framework. To solve this issue, the Ministry of Communities and Territories Development has developed the document No 3 This draft law has been developed jointly with the Ukrainian State Research Institute of Urban Development "Dipromisto". The intention of the draft law is to address maximum issues to start the process of rehabilitating obsolete housing estates. In particular, the possibility of reconstruction of obsolete housing of different heights, and not just five-storey buildings, has been taken into account. The draft law stipulates that about 70% of the votes of the population of the houses are sufficient to approve the renovation. The developed draft law defines the executive bodies of the city and village councils as the executive bodies that order reconstruction projects. It expands the list of possible sources of project financing, while defining the algorithm for making a decision on reconstruction or demolition. The draft law also improves the compensation procedure for the owners of obsolete flats. It considers various opportunities for the resettlement of the population during reconstruction, the maximum distance to which resettlement will take place, and some other issues.

Complex reconstruction measures include: reconstruction of blocks of flats within a district (microdistrict); modernisation of blocks of flats within a district (microdistrict); demolition of blocks of flats within a district (microdistrict) followed by new construction; reconstruction of engineering, transport and social infrastructure facilities located within a particular district (microdistrict). The method of implementation can be chosen mainly on the basis of renovation programmes, which will be developed taking into account the results of technical inspections of the buildings and facilities, their energy audits and some technical and economic calculations.

This Draft Law also provides for the distribution of responsibilities between public authorities and property developers. The sphere of responsibility of the public authorities will include: planning a comprehensive reconstruction of micro-blocks according to the zoning

plan; development and approval of large-scale planning documentation; engineering training, creation of infrastructure and landscaping at the expense of public funds, local budgets, and private developers; conducting transparent investment tenders to find a developer. Developers are responsible for designing the reconstruction project and reviewing the project documentation; obtaining permission to perform construction work on sites. The developer is also directly responsible for the construction of blocks of flats and commissioning, providing a share of the flats in the buildings for the owners of flats in the buildings to be demolished, and the strict compliance with the terms of the deposit agreement, including the completion deadline. According to the experts, this Draft Law is more inclusive of the rights of settlers than in the previous version. However, weaknesses are also found in the presented document (Belleri and Marini, 2016).

Market participants point out that it does not give any benefits or preferences to those who win the renovation tender, i.e., developers. Having built a twenty-storey building instead of a five-story one, developers will undoubtedly benefit by receiving funds for a bigger number of flats (this depends on the ratio of cost and price of housing). However, the state does not provide for either a simplified project approval operation or some other bureaucratic exemptions for the construction companies (Carli *et al.*, 2018). Most importantly, a functioning model must be established. First and foremost, at a national programme level, where the responsible Ministry would have a decisive managerial role in the context of plans for the replacement of the emergency housing stock, rather than an advisory role as is currently envisaged (Achtnicht and Madlener, 2014). In the analysis, the following issues have been identified:

1. It is cumbersome and multidisciplinary, difficult to perceive comprehensively.
2. It contains bottlenecks, for example: preliminary preparatory budget expenditures that may not be justified; uncertainties regarding land; difficulties in making investment decisions; complexity of joint decision-making by residents; judicial procedures; alignment during eviction.
3. It has economic substance involving the search for investment-efficient and mutually beneficial options for the participants, with a higher level of efficiency through the participation of state, local, and other funds raised by the authorities.
4. It provides additional opportunities. It is more sustainable to rent the flats available on the market, instead of building temporary public housing. Social rental housing can be offered on a permanent basis. A preferential mortgage (if established).
5. It determine the preference for communal land ownership in this project, if another is not already in place.
6. It allows inexpediency of providing housing ownership to subsidised (inefficient owners).
7. In general, the Law does not fully comply with the concept of property that disappears if the house is to be demolished and loses value (apart from land ownership, if any).
8. Building information modelling should be considered in secondary use projects (separate project).

Some issues require the preparation and execution of a situation play (business game). An experiment such as a pilot project with relevant Cabinet of Ministers decree or decisions at the regional or local level is required. After that, this law must be adopted. The central administration should show the passion of the state in this matter, help developers and investors, and review the implementation of the programme. Without state support under the auspices of the national authorities, plans for the rehabilitation of obsolete flats cannot be realised. The experts also point out the need to carefully study the experience of countries where similar renovations of old houses have already taken place to avoid repeating the same mistakes. The experience of numerous liberal construction projects has spread to the states of Eastern Europe. In fact, there it has gone much further in the modernisation of the flat stock (Belleri and Marini, 2016).

To present the data on funding allocations for the reconstruction, overhaul, and technical re-equipment of blocks of flats in various Ukrainian cities, the information had been organized into tables. Tables 1 and 2 outline the funds allocated by different city councils over specified years, offering a comparative perspective on the budgetary focus on housing renovations across these cities.

Table 1: Funding allocations for housing renovation in Ukrainian cities (2019-2021), UAH

City Name	Population	2019 Funding (UAH)	2020 Funding (UAH)	2021 Funding (UAH)
Obukhiv	33,600	1,273.600 (avg)	1,273.600 (avg)	1,392.600
Netishyn	36,000	7,967.000 (avg)	7,967.000 (avg)	7,967.000 (avg)
Rubizhne	56,000	5,000.000	5,000.000	5,000.000
Boryspil	>60,000	6,960.000 (avg)	6,960.000 (avg)	6,960.000 (avg)
Slovyansk	107,000	32,549.990	30,575.600	28,936.000
Uzhhorod	116,000	21,051.000 (avg)	22,150.000 (avg)	22,150.000 (avg)
Kramatorsk	185,000	48,290.000	57,160.000	63,455.000
Bila Tserkva	208,000	4,000.000	10,000.000	20,000.000
Lutsk	244,000	27,000.000	30,000.000	33,100.000
Cherkasy	273,500	37,000.000	38,000.000	40,000.000
Khmelnitsky	274,000	40,000.000	50,000.000	60,000.000
Chernihiv	285,200	8,000.000 (avg)	8,000.000 (avg)	8,000.000 (avg)
Lviv	718,000	42,942.653	60,000.000 (avg)	60,000.000 (avg)
Zaporizhzhia	722,000	23,493.219	42,942.653	45,145.000

Source: Bila Tserkva City Council (2021), Boryspil City Council (2021), Cherkasy City Council (2021), Chernihiv City Council (2021), Khmelnytsky City Council (2021), Kramatorsk City Council (2021), Lutsk City Council (2021), Lviv City Council (2021), Netishyn City Council (2021), Obukhiv City Council (2021), Rubizhne City Council (2021), Slovyansk City Council (2021), State Statistics Service of Ukraine (2021), Uzhhorod City Council (2021), Zaporizhzhia City Council (2021).

Table 2: Estimated costs for major repairs and reconstructions of housing stock (2019-2023), UAH

City Name	Population	2019 Cost	2020 Cost	2021 Cost	2022 Cost	2023 Cost
Bila Tserkva	208,000	4,000.000	10,000.000	20,000.000	30,000.000	30,000.000
Lutsk	244,000	25,000.000	30,000.000	33,100.000	38,000.000	39,400.000
Cherkasy	273,500	20,000.000	30,000.000	40,000.000	50,000.000	60,000.000
Khmelnitsky	274,000	40,000.000	50,000.000	60,000.000	70,000.000	75,000.000
Chernihiv	285,200	8,000.000 (avg)	8,000.000 (avg)	8,000.000 (avg)	8,000.000 (avg)	8,000.000 (avg)
Lviv	718,000	60,000.000 (avg)	60,000.000 (avg)	60,000.000 (avg)	60,000.000 (avg)	60,000.000 (avg)
Zaporizhzhia	722,000	23,493.219	42,942.653	55,346.346	67,356.403	74,230.738

Source: Bila Tserkva City Council (2021), Lutsk City Council (2021), Cherkasy City Council (2021), Khmelnytsky City Council (2021), Chernihiv City Council (2021), Lviv City Council (2021), Zaporizhzhia City Council (2021).

In the case of heating networks, which are an important part of the quality functioning of blocks of flats, the estimated cost of renovating and repairing this system will be UAH 64 billion (Zanuda, 2020). Thus, there is a great variation in the need for restoration and renovation of the housing stock from city to city. However, given the number of residents in the cities in question, it is possible to give a rough estimate of the cumulative cost of repairs. Every year, the city councils, and associations of co-owners of blocks of flats allocate from UAH 28000 to

343000 for renovation, reconstruction, maintenance, and capital repairs for every 1000 residents of the city. On average, Ukrainian cities spend UAH 149000 a year per 1000 inhabitants to improve housing conditions. According to the State Statistics Service of Ukraine (2021), the country's urban population is 2139.346 people. Thus, the amount currently allocated for the reconstruction, maintenance and capital repairs of the housing stock is approximately UAH 4341762.600 per year. The duration of the renovation programmes in Ukrainian cities is usually 3-5 years, which means that the total cost of all renovations is about UAH 17367050.400. However, one programme is always followed by another, which suggests that the process does not cover all of the houses requiring renovation. Based on these observations, as well as the data discussed above, it is estimated that the accumulated cost of necessary maintenance, major repairs, and reconstruction of residential buildings is at twice the amount spent UAH 34734100.800. The resulting amount reflects the need for stable and sufficient funding.

It is known that the total area of residential premises in Ukraine as of January 1, 2021, amounted to 1014775.400 m² and 17407.700 flats. At the same time, 45598 buildings had the status of dilapidated (total area of 3326.500 m²) and 17254 buildings had the status of hazardous (total area of 1011.400 m²). Thus, 62852 houses with a total area of 4337.900 m² require urgent repairs (State Statistics Service of Ukraine, 2021). It is estimated that the cost of renovating one m² of the premises is usually 30-50% of the cost of building one m² of new housing (Order of the Ministry of Housing and Communal Services No. 21 "On approval of the SOU ZhKH 75.11-35077234.NNNN: 2009 "Residential buildings. Rules for determining the physical wear and tear of residential buildings"", 2009). Thus, according to Order of the Ministry of Development of Communities and Territories of Ukraine No. 119 "On indicators of indirect cost of housing construction by regions of Ukraine". (2021) the average cost of construction of 1 m² of new housing as of May 20, 2021, was UAH 14038 including VAT (value-added tax). Considering inflation, the rising cost of construction materials, the construction cost being tied to foreign currency exchange rates, deterioration of the state of housing stock over time, etc., the following calculations of the cost of renovating 1 m² in a block of flats will be based on a unit cost of 45% of the cost of building a new dwelling:

$$(14038 * 45\%) * 4337,9 = \text{UAH } 27,402.948 \quad (1)$$

Therefore, the difference between estimates based on centralised data of the Ministry and actual estimates of local administrations is about 10 billion hryvnias. Since the end of the Second World War, a housing crisis in Western and Eastern Europe has been acute in large cities due to war devastation and an increase in the number of inhabitants. In this regard, in the mid-20th century, mass house building piloted the construction of affordable compact flats. In these conditions, little attention has been paid to the quality, comfort, durability, and energy efficiency of the housing (Borysova *et al.*, 2019). By the end of 1960, the share of the largest construction in the housing sector in France was 52%, in Germany 67%, in Finland 72%, and in Sweden 55-68% (Belleri and Marini, 2016). Studies have shown that the requirements of the people for the quality of flats change every 8 years. Thus, at the beginning of 1980, these houses did not meet the housing standards, normative and technical requirements of that time and therefore needed to be repaired. Reconstruction of prefabricated blocks of flats was carried out in the following ways: adding another storey; adding loggias, balconies, terraces; rebuilding a house to change its design (with selective dismantling, adding new fragments); modifying the building appearance by changing facades, replacing balconies and loggias. At the same time, the process of reconstruction of blocks of flats was accompanied by a transition to new, more energy-efficient heating systems with the replacement of technical equipment (Hargreaves *et al.*, 2017).

Housing reconstruction projects require huge investments. Thus, it is not easy to implement them without state support. In this context, European governments have developed state programmes for the refurbishment of blocks of flats, for which the state subsidies and soft loans are provided (Yaroshenko *et al.*, 2021). France has four government programmes for the

reconstruction of urban housing, namely: a housing improvement programme, i.e., providing subsidies to flat owners up to 35% of labour costs and benefits (for the refurbishment of no longer than three years) under certain conditions; thematic social programmes, i.e, providing subsidies to flats owners for up to 70% of the price of low-rise renovation work for low-income citizens; the building renovation programme providing substantial tax breaks for flat owners

In case of refusal, the municipality has the right to sell the building to an investor for renovation, a programme for eliminating houses with poor housing conditions, providing a number of subsidies to the homeowner for demolition and reconstruction of the old flats. In case of refusal, the state has the right to perform the necessary work at the expense of the homeowner. Modern technologies of reconstruction of residential buildings in France using new equipment, resource-saving technologies and efficient materials allow repairing a residential building in 3-6 months, depending on the volume of repairs. Reconstruction of blocks of flats is usually carried out without eviction of tenants with maximum respect for their living conditions (Ferrer, Thome and Scavarda, 2018).

Strategies

Many cities in Ukraine are working on developing an urban transformation strategy to move from traditional to sustainable cities. Improving the energy efficiency of buildings, especially existing ones, is key to combating climate change. Pardo-Bosch, Cervera and Ysa (2019) use a business perspective to analyse and compare the three main modernisation measures that are being implemented in three different European cities, Nantes, Hamburg, and Helsinki, to cover key needs and challenges and identify recommendations from local authorities to repeat and expand modernisation. Municipal business models for residential refurbishment that differ from those of private companies, using two innovative business tools have been analysed: the Value Creation Ecosystem (VCE) and the City Model Canvas (CMC). Sustainable development in terms of social integration, environmental protection and financial viability are the main focus of the study. It is challenging to engage owners in the modernisation of blocks of flats because of the high start-up costs (Bieliatynskyi *et al.*, 2022). An analysis of the business models of the three cities reveal interesting ideas to support this type of intervention. Development of a client interface managed by the municipality; Offering financing schemes, supporting risk-sharing schemes and guaranteeing savings through EPC (engineering, procurement and construction), and engaging owners in co-creation strategies using 4P approaches. All of this contributes to the city's efforts to increase access for owners willing to take part. These results and discussions will help public managers to prepare city strategies on business models when implementing building retrofit projects.

Renovation of the reinforced concrete buildings after the Second World War was an urgent measure to achieve energy savings and security among European communities. In this context, a new incremental rehabilitation approach was introduced to overcome major obstacles to reconstruction and increase the feasibility of thorough, sustainable reconstruction (Annenkov, 2022). This new approach has the primary objective of supporting the development of a safer, as well as more sustainable, society by incorporating the principles of life cycle thinking and introducing additional levels of security. The study identifies a strategy and applies it to the reference building. The main criteria for choosing the right reconstruction strategy that guarantees minimal environmental impact and applicability to existing precast concrete frames are derived. Study results suggest that a holistic gradual recovery strategy may be a good response to the urgent need for a sustainable recovery of the Italian and European housing stock (Zanni *et al.*, 2019). In countries with market economies, a significant part of investment goes to the reconstruction of blocks of flats (Trusova *et al.*, 2021).

Therefore, the Germans began a comprehensive reconstruction and modernisation of old and energy-efficient flats. The renovation of residential buildings in Germany had three main objectives: to restore the full technical condition of the house and, as a consequence, to extend its life; to improve the living conditions in the house; to increase its comfort level; and to introduce energy-saving measures. In many areas, rehabilitation took place without moving of tenants. For this reason, special requirements are put forward for the organisation of

construction, especially for work with the least number of complaints from residents. To do this, a special consultant worked at the construction site, who was able to answer all the questions about construction work in real time. The housing agencies hired several companies.

In all contracts, there was a condition: if one of the companies does not fulfil its obligations, the other fulfils them, thereby taking on an additional load (Voitovych *et al.*, 2023). Thus, the tenants were guaranteed work completed in a timely manner. In addition, the priority was the quality of work, the owner's representatives documented all the work done daily (Brown, 2018). Modernisation of heating, sewerage and ventilation systems meant further work inside the flats, followed by renovation of the bathrooms and kitchens. Repairs inside one flat lasted only 5 days due to the use of factory structures. Repair work on different floors was synchronised on risers, allowing residents to use the adjacent bathrooms and kitchens (Drew and Dollery, 2015).

However, the average monthly salary in Germany is nine times higher than in Ukraine (end of 2020). Thus, the possibility of serious financing of restoration work by the Ukrainian society is out of question. Effective principles of conducting information campaigns may also be of interest to Ukrainian specialists. Under German law, the issue of modernisation and major repairs of a multi-storey residential building is decided by voting of at least 75% of those present at the meeting. Instead, 50% of the participants' votes are enough to make a decision on the current amendments. If a cooperative or limited liability company is established in a building, the decision is made by the management or board of directors (Díaz-Díaz, Muñoz and Pérez-González, 2017). According to the German Civil Code, residents of multi-storey buildings must be notified in writing of future upgrades and nuisances at least three months in advance. Besides, they must receive all reasonable calculations. Given that most of the work was done without relocating inhabitants, it is important to carefully organise community outreach. However, it is extremely important to ensure order and transparency in the behaviour of residents during rehabilitation operations (Ciulla, Galatioto and Ricci, 2016).

For this purpose, each house has a special office for working with residents. These offices interview homeowners, coordinate all co-financing, paperwork, meetings, and inform residents about all stages of repairs. The department provides each of them with written information about the volumes of construction work. In addition, brochures are printed and distributed, photos and work schedules are published, and model exhibitions of new building materials and films are shown (Brown, 2018). Representatives of the office visit each flat, conduct inventory, and communicate with residents. A particular problem was working with people who were uncomfortable, in particular, because of the inconvenience of the construction work (noise, dirt, regular downtime). Most of them were families with children, the elderly and the disabled. The personal affairs of vulnerable people were therefore dealt with promptly by the “care home” contact persons appointed by the authorities (e.g., relocation and accommodation in temporary accommodation as necessary). Furthermore, Ukraine may be interested in funding mechanisms for modernisation activities, experience in organising work across the country, and strict adherence to schedules (Ahmad *et al.*, 2018).

The economic analysis of the current situation in Ukraine regarding the renovation of high-rise apartments reveals a multifaceted scenario influenced by various economic, legal, and social factors. Firstly, the introduction of the new draft law by the Ministry of Communities and Territories Development, developed in collaboration with the Ukrainian State Research Institute of Urban Development “Dipromisto,” is a significant step towards addressing the legal and procedural gaps hindering investments in housing renovations. This law, which facilitates the reconstruction of housing of varying heights and not just five-story buildings, is expected to open new avenues for investors and property developers. However, it also raises questions about the economic feasibility of such projects, particularly in terms of funding and the return on investment for developers. The stipulation that about 70% of the votes of a building's population are sufficient to approve renovation highlights a shift towards a more democratic process. However, this could also lead to potential delays and disagreements among residents, impacting the economic timeline of projects. Additionally, the law's focus on expanding the sources of project financing and improving compensation procedures for owners of obsolete

flats indicates an attempt to balance the interests of different stakeholders. However, the complexity of these processes could lead to increased administrative costs and time delays.

From an investment perspective, the analysis of funding allocations by various Ukrainian city councils for housing renovation (as outlined in the provided tables) underscores the commitment of local governments to improving housing conditions. However, there is significant variation in the funding amounts, which could reflect disparities in the urgency or scale of the housing issues in different regions. Moreover, the reliance on city budgets and co-financing from condominiums suggests a model where financial burdens are shared, but this might not be sustainable in the long term, especially in cities with limited financial resources. The economic substance of the renovation projects involves finding investment-efficient and mutually beneficial options for all participants. This includes the involvement of state, local, and other funds raised by authorities. The approach suggests a move towards more public-private partnerships, but it also highlights the need for efficient management of such collaborations to ensure that they are economically viable.

The analysis also points to additional opportunities such as renting flats available on the market instead of building temporary public housing, offering social rental housing on a permanent basis, and establishing preferential mortgages. These alternatives could present more cost-effective solutions than extensive reconstruction projects, especially in light of the considerable financial requirements identified in the assessment of renovation costs. Furthermore, the comparison with European models of housing renovation, particularly the German approach, provides valuable insights. The German model, which emphasizes comprehensive reconstruction and modernization with a focus on energy efficiency and tenant comfort, could serve as a benchmark for Ukraine. However, the economic context in Ukraine, particularly the lower average monthly income compared to Germany, poses a challenge in replicating this model. It indicates a need for tailored solutions that consider the unique economic conditions in Ukraine.

In conclusion, the economic analysis suggests that while the new legal framework and the commitment of city councils are steps in the right direction, there are significant economic challenges that need to be addressed. These include ensuring the feasibility of projects for investors and developers, managing the financial burden on local governments and residents, and adapting successful international models to the Ukrainian context. Addressing these challenges will be crucial for the successful renovation and modernization of the high-rise apartment stock in Ukraine.

The research on renovating high-rise apartments in Ukraine uncovers distinct problems and potentials. The main issues include an incomplete legal framework impeding investor involvement, the aging and inefficient infrastructure of the existing housing stock, and financial and administrative challenges, particularly in regions with limited resources. These problems are compounded by complex decision-making processes and disparities in renovation funding and progress across different areas. On the positive side, there are significant opportunities for improvement. The new legal provisions expand the scope of renovation projects and introduce diverse financing sources, potentially attracting private investment and fostering public-private partnerships. Adopting European models focused on energy efficiency and tenant comfort presents a chance to upgrade living conditions and align with global sustainability trends. Moreover, the use of modern technologies like Building Information Modeling (BIM) in renovations indicates a move towards more innovative urban development.

Conclusions

The current state of Ukraine's housing stock underscores an urgent need for reconstruction, driven by several critical reasons. Firstly, the age of the buildings is a primary concern. More than half of the residential blocks were constructed over fifty years ago, making them prone to significant physical deterioration. Without timely intervention, these buildings may soon reach a point of 80% physical deterioration, beyond which rehabilitation becomes impractical and economically unfeasible. Another compelling reason for reconstruction is the inability to rapidly construct new housing as a substitute for the aging stock. The time and

resources required to build new residences from scratch are considerable, making it an unrealistic solution in the short term. This situation necessitates the restoration and modernization of the existing buildings as a more immediate and practical approach.

Current legal framework in Ukraine also presents challenges, particularly for the investors interested in modernization projects. Inadequacy of legal provisions hinders the initiation and progress of these projects. The Ministry of Development of Communities and Territories of Ukraine's efforts in developing a new Draft Law to address comprehensive reconstruction is a step towards resolving these legal obstacles. Moreover, the socio-economic impact of housing renovation cannot be overlooked. Modernizing the housing stock is not only about maintaining buildings in a satisfactory condition but also about enhancing the living standards of residents. Improved housing conditions contribute to the social welfare of the community and have broader economic benefits.

In conclusion, the reconstruction of Ukraine's housing stock is not just a structural necessity but also a socio-economic imperative. The reasons for reconstruction – aging infrastructure, the impracticality of new construction, legal challenges, and socio-economic benefits – form the basis of this pressing need. While the current research provides foundational insights, further investigation into these aspects is essential for developing comprehensive strategies for housing reconstruction in Ukraine.

References

- Achtnicht, M. & Madlener, R. (2014) 'Factors influencing German house owners' preferences on energy retrofits', *Energy Policy*, 68, pp. 254–263. Available at: doi: 10.1016/j.enpol.2014.01.006.
- Addanki, S. C. & Venkataraman, H. (2017) 'Greening the economy: A review of urban sustainability measures for developing new cities', *Sustainable Cities and Society*, 32, pp. 1–8. Available at: doi: 10.1016/j.scs.2017.03.009.
- Ahmad, T. & Thaheem, M. J. (2018) 'Economic sustainability assessment of residential buildings: A dedicated assessment framework and implications for BIM', *Sustainable Cities and Society*, 38, pp. 476–491. doi: 10.1016/j.scs.2018.01.035.
- Ahvenniemi, H., Huovila, A., Pinto-Seppä, I. & Airaksinen, M. (2017) 'What are the differences between sustainable and smart cities?' *Cities*, 60, pp. 234–245. doi: 10.1016/j.cities.2016.09.009.
- Annenkov, A. (2022) 'Monitoring the deformation process of engineering structures using BIM technologies', *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, 46 (5/W1-2022), pp. 15–20. doi: 10.5194/isprs-archives-XLVI-5-W1-2022-15-2022.
- Belleri, A. & Marini, A. (2016) 'Does seismic risk affect the environmental impact of existing buildings?' *Energy and Buildings*, 110, pp. 149–158. doi: 10.1016/j.enbuild.2015.10.048.
- Bieliatynskyi, A., Yang, S., Pershakov, V., Shao, M. & Ta, M. (2022) 'The use of fiber made from fly ash from power plants in China in road and airfield construction', *Construction and Building Materials*, 323, Article number: 126537. doi: 10.1016/j.conbuildmat.2022.126537.
- Bila Tserkva City Council (2021) <http://www.bilatserkva.info/>.
- Borysova, V. I., Ivanova, K. Y., Iurevych, I. V. & Ovcharenko, O. M. (2019) 'Judicial protection of civil rights in Ukraine: National experience through the prism of European standards', *Journal of Advanced Research in Law and Economics*, 10 (1), pp. 66-84. doi: 10.14505/jarle.v10.1(39).09.
- Boryspil City Council (2021) <https://borispol-rada.gov.ua/>.
- Brown, D. (2018) 'Business Models for Residential Retrofit in the UK: a Critical Assessment of Five Key Archetypes', *Energy Efficiency*, 11 (6), pp. 1497–1517. <https://link.springer.com/article/10.1007/s12053-018-9629-5>

- Büyüközkan, G. & Karabulut, Y. (2018) 'Sustainability performance evaluation: Literature review and future directions', *Journal of Environmental Management*, 217, pp. 253–267. doi: 10.1016/j.jenvman.2018.03.064.
- Carli, R., Dotoli, M. & Pellegrino, R. (2018) 'Multi-criteria decision-making for sustainable metropolitan cities assessment', *Journal of Environmental Management*, 226, pp. 46–61. doi: 10.1016/j.jenvman.2018.07.075.
- Cherkasy City Council (2021) <https://www.oblradack.gov.ua/>.
- Chernihiv City Council (2021) <https://www.chernigiv-rada.gov.ua/>.
- Ciulla, G., Galatioto, A. & Ricciu, R. (2016) 'Energy and economic analysis and feasibility of retrofit actions in Italian residential historical buildings', *Energy and Buildings*, 128, pp. 649–659. doi: 10.1016/j.enbuild.2016.07.044.
- Diatlova V. & Diatlova Yu. (2021) 'Territorial development management on the basis of housing renovation: Essence and modern approaches in the world and Ukraine', *Manager. Bulletin of Donetsk State University of Management*, 91 (2), pp. 36–46. doi: 10.35340/2308-104X.2021.91-2-04.
- Díaz-Díaz, R., Muñoz, L. & Pérez-González, D. (2017) 'The business model evaluation tool for smart cities: Application to smartantander use cases', *Energies*, 10 (3), pp. 256–262. doi: 10.3390/en10030262.
- Draft Law of Ukraine "On Amendments to the Law of Ukraine "On comprehensive reconstruction of blocks of buildings (micro-districts) of the outdated residential housing stock"" (2021) <https://cutt.ly/PHAm8m1>.
- Drew, J. & Dollery, B. (2015) 'Inconsistent Depreciation Practice and Public Policymaking: Local Government Reform in New South Wales', *Australian Accounting Review*, 25 (1), pp. 28–37. doi: 10.1111/auar.12072.
- Ferrer, A. L. C., Thome, A. M. T. & Scavarda, A. J. (2018) 'Sustainable urban infrastructure: A review', *Resources, Conservation and Recycling*, 128, pp. 360–372. doi: 10.1016/j.resconrec.2016.07.017.
- Haran, O. V. & Stepanova, T. V. (2023) 'Current issues of the institute of social housing: Administrative aspect', *Naukovi perspektivi*, 4 (34), pp. 372–383. doi: 10.52058/2708-7530-2023-4(34)-372-383.
- Hargreaves, A., Cheng, V., Deshmukh, S., Leach, M. & Steemers, K. (2017) 'Forecasting how residential urban form affects the regional carbon savings and costs of retrofitting and decentralized energy supply', *Applied Energy*, 186, pp. 549–561. doi: 10.1016/j.apenergy.2016.02.095.
- Horislavska, I. V. (2019) 'International experience of legal regulation of housing fund management', *Law. Human. Environment*, 10 (2), pp. 120–125. doi: 10.31548/law2019.02.015.
- Kerimkhulle, S., Mukhanova, A., Kantureyeva, M., Koishybaeva, M. & Azieva, G. (2023) 'Applying a housing construction model to improve a small town demographic dynamics', *AIP Conference Proceedings*, 2700, Article number: 040047. doi: 10.1063/5.0125066.
- Khmelnitsky City Council (2021) <https://mycity.khm.gov.ua/>.
- Khudiakov, I. & Sukhonos, M. (2021) 'Adaptive approach to engineering infrastructure reconstruction program and project management', *Development Management*, 19 (4), pp. 17–26. doi: 10.57111/devt.19(4).2021.17–26.
- Kramatorsk City Council (2021) <https://krm.gov.ua/>.
- La Greca, P. & Margani, G. (2018) 'Seismic and energy renovation measures for sustainable cities: A critical analysis of the Italian scenario', *Sustainability*, 10 (1), Article number: 254. doi: 10.3390/su10010254.
- Law of Ukraine No. 525-V "On Comprehensive Reconstruction of Blocks of Buildings (Micro-districts) of the Outdated Residential Housing Stock" (2006) <https://zakon.rada.gov.ua/laws/show/525-16#Text>.
- Lutsk City Council (2021) <https://www.lutskrada.gov.ua/>.
- Lviv City Council (2021) <https://city-adm.lviv.ua/>.

- Marini, A., Passoni, C., Belleri, A., Feroldi, F., Preti, M., Metelli, G. & Plizzari, G. (2017) 'Combining seismic retrofit with energy refurbishment for the sustainable renovation of RC buildings: A proof of concept', *European Journal of Environmental and Civil Engineering*, 26 (7), pp. 2475–2495. <http://dx.doi.org/10.1080/19648189.2017.1363665>.
- Netishyn City Council (2021) <https://www.netishynrada.gov.ua/>.
- Obukhiv City Council (2021) <https://obcity.gov.ua/>.
- Order of the Ministry of Development of Communities and Territories of Ukraine No. 119 "On indicators of indirect cost of housing construction by regions of Ukraine" (2021) <https://www.minregion.gov.ua/wp-content/uploads/2021/05/nakaz-119-vid-20.05.2021.pdf>.
- Order of the Ministry of Housing and Communal Services No. 21 "On approval of the SOU ZhKH 75.11-35077234.NNNN: 2009 "Residential buildings. Rules for determining the physical wear and tear of residential buildings"" (2009) <https://zakon.rada.gov.ua/rada/show/v0021662-09#Text>.
- Pardo-Bosch, F., Cervera, C. & Ysa, T. (2019) 'Key aspects of building retrofitting: Strategizing sustainable cities', *Journal of Environmental Management*, 248, Article number: 109247. doi: 10.1016/j.jenvman.2019.07.018.
- Pleshkanovska, A. & Biriuk, S. (2021) 'Outdated housing stock' as an object of complex reconstruction programs and projects: challenges for Ukraine', *Journal of Urban and Regional Analysis*, 13 (2), pp. 257–280.
- Rasulov, Kh. Z., Toshmatov, E. S. & Artykbaev, D. Zh. (2023) 'Earthquake-Resistant Steepness of Slope Structures', *AIP Conference Proceedings*, 2612, Article number: 020006. doi: 10.1063/5.0113268.
- Reznik, P., Almohamad, M. & Tenesescu, V. (2022) 'Analysis of constructive solutions of the existing buildings of the housing fund of the Kharkiv city on the subject of their performance as a consequence of the influence of combat actions', *Collection of Scientific Works of the Ukrainian State University of Railway Transport*, 201, pp. 41–56. doi: 10.18664/1994-7852.201.2022.267755.
- Rubizhne City Council (2021) <https://rmr.gov.ua>.
- Serdiuk, V. R., Franyshyna, S. Yu., Serdiuk, T. V. & Chrystych, O. V. (2022) 'Organizational and Technological Measures of Thermomodernization of Obsolete Housing Fund', *Visnyk of Vinnytsia Polytechnical Institute*, 2, pp. 6–17. doi: 10.31649/1997-9266-2022-161-2-6-17.
- Shevchenko, L. S. (2020) 'Second life of the residential building area of the middle of the 50s – early 80s of the twentieth century in Ukraine: Opportunities and perspectives', *Lecture Notes in Civil Engineering*, 73, pp. 449–461.
- Shtendera, A. (2021) 'Methods for assessing the transport and pedestrian accessibility of multi-storey residential buildings and complexes, as well as their impact on the city infrastructure', *Architectural Studies*, 7 (2), pp. 227–234. doi: 10.23939/as2021.02.227.
- Sloviansk City Council (2021) <http://www.slavrada.gov.ua/?view=city>.
- State Statistics Service of Ukraine (2021) <http://www.ukrstat.gov.ua/>.
- Sun, J., Bieliatynskiy, A., Krayushkina, K. & Akmaldinova, O. (2020) 'Research of properties on graphite conductive slag in asphalt concrete', *E3S Web of Conferences*, 175, Article number: 11015. doi: 10.1051/e3sconf/202017511015.
- Troian, V., Gots, V., Flatt, R. J. & Angst, U. (2024) 'Rehabilitating instead of rebuilding aged or damaged pre-fabricated concrete buildings for reducing CO2 emissions: the case of Ukraine', *Materials and Structures/Materiaux et Constructions*, 57 (1), 14.
- Trusova, N. V., Cherniavska, T. A., Kyrylov, Y. Y., Hranovska, V. H., Skrypyk, S. V. & Borovik, L. V. (2021) 'Ensuring security the movement of foreign direct investment: Ukraine and the EU economic relations', *Periodicals of Engineering and Natural Sciences*, 9 (3), pp. 901–920.
- Trusova, N. V., Karman, S. V., Tereshchenko, M. A. & Prus, Y. O. (2018) 'Debt burden of the financial system of Ukraine and countries of the Eurozone: Policy of regulating of the risks', *Espacios*, 39 (39). Available at: <https://www.revistaespacios.com/a18v39n39/a18v39n39p30.pdf>

- Uzhhorod City Council (2021) <https://rada-uzhgorod.gov.ua/>.
- Voitovych, V., Emelianova, O., Tytok, V., Pokolenko, V. & Pylypchuk, O. (2023) 'Optimization of the Load of Production Units of the Construction Company', *WSEAS Transactions on Information Science and Applications*, 20, pp. 228–237. doi: 10.37394/23209.2023.20.26.
- Yaroshenko, O. M., Lutsenko, O. YE. & Vapnyarchuk, N. M. (2021) 'Salary optimisation in Ukraine in the context of the economy Europeanisation', *Journal of the National Academy of Legal Sciences of Ukraine*, 28 (3), pp. 224–237. doi: 10.37635/jnalsu.28(3).2021.224-237.
- Zanni, J., Labò, S., Passoni, C., Casprini, E., Marini, A., Belleri, A. & Menna, C. (2019) 'Incremental integrated holistic rehabilitation: A new concept to boost a deep renovation of the existing building stock', *Earth and Environmental Science*, 290, Article number: 012140. doi: 10.1088/1755-1315/290/1/012140.
- Zanuda, A. (2020) *Killed housing: how many in Ukraine and how to resuscitate it*. <https://www.bbc.com/ukrainian/features-53809075>.
- Zaporizhzhia City Council (2021) <https://zp.gov.ua/uk>.