Innovative Approaches in the Period of Mass Industrial Development (on the Example of Residential Areas of Kharkiv)

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Abstract. The article considers architectural, city planning, engineering and technological innovations in the building industry that were carried out in Kharkiv in the 1960-1980s and led to profound changes in the social organization of city life. During these years, Kharkiv confirmed its reputation of the scientific and technical capital of Ukraine in the field of architecture and city planning. The most important innovations that were worked out in Kharkiv as in one of the largest cities include the microdistrict system, a stepped public service system, and the focusing method in city planning. It was also innovative to create standard series of residential buildings for mass industrialized development at Kharkivproekt and Ukrmistobudproekt institutes. Technological innovations were created in high-tech house-building plants, organizational and managerial ones – in managerial combines capable of coordinating the entire project and investment cycle. Mass industrial residential development in the mid-1980s allowed liquidation of the housing crisis in Kharkiv. However, this period gave rise to a number of problems in functioning and maintenance of the huge residential areas created at that time. Analysis and objective assessment of the achievements and mistakes of the era of mass industrial construction is a task of current interest for Ukrainian architectural science.

Introduction
In the 60s - 80s years of the past century, Kharkiv, as before in the 1920s and 1930s, was one of the leading experimental sites for urban planning, architecture and new building technologies. A large-scale program to provide the population with individual housing has opened a new stage in urban development in the former Soviet Union. Its implementation was expressed in numerous architectural and urban and engineering and technological innovations, encouraged the construction industry to form a new design typology, caused profound changes in the social organization of life of citizens. The role of the Kharkiv school of architecture and construction during this period was not limited to the implementation and testing of solutions created in central research and experimental design institutions. During these years, Kharkiv, confirming its reputation as the scientific, technical and educational capital of Ukraine, was a source of many significant innovations in architecture and urban development. Innovations in the design and implementation of mass industrial construction in Kharkiv covered numerous kinds of architectural, city planning, typological, organizational, managerial, engineering and technological innovations.
The relevance of studying the period of mass industrial development today is evolving by the fact that large Ukrainian cities again, as half a century ago, are faced with a choice of strategies for spatial development, technological modernization and the beginnings of reorganization of urban life. Turning to their own experience from the middle of the twentieth century could clarify why and how in those years it was possible to organize and implement large-scale, truly innovative transformations in the huge and complex sphere of housing policy and urban development. The fact that the content of these transformations is relevant today not only in historical-theoretical, but also in practical and organizational terms, shows, in particular, the active and growing interest of Western researchers to the Soviet and, in particular, to the Kharkiv experience. Examples include research projects led by Theo Hauben (Rotterdam, the Netherlands) [1], Philipp Moiser (Berlin, Germany) [2], or Barbara Engel (Karlsruhe, Germany) [3]. This series can be extended.

In the history of national architecture, the representation of this most important stage in the development of post-war architecture still cannot find integrity. On the one hand, this period is quite thoroughly interpreted as a fundamental turn to solve the housing problem, to modernize the settlement system, social services, as well as all life support systems of the city and to realize the technological re-equipment of construction, and finally to return the architecture and urban planning in the USSR on the main path of world architecture development. On the other hand, the same era appeared as responsible for violating the traditional way of urban environment, for the loss of cities of individuality and human scale, for the dehumanization of the environment, – and all this combined with reproaches for secondary and non-independence, schematic urban thinking and primitive technical solutions.

The purpose of this publication is to approach the formation of a holistic picture of changes in the architectural and urban planning sphere that occurred during the enrolment of mass industrial development, on the example of a large Ukrainian city, highlighting the innovative components in each of the main aspects of this picture – urban and planning, architectural and typological, engineering-technological and socio-functional.

Such a definition of the goal raises quite specific research objectives, most of which have been ignored by scientists for several decades, despite their obvious importance in gaining a systematic view of the recent history of Ukrainian city planning area. This is, firstly, a reproduction of a chronological sequence of events that determine the shift to industrialization of the city planning, and, secondly, closely related to the first task of identifying key figures – organizers, architects and engineers who had the greatest innovative contribution to creation of qualitatively new structures of research and experimental design as also of the building production systems.

This is followed by the task of identifying a system of innovations and, among them, those fundamental innovations that have allowed to create unprecedented in the history of construction technological processes of industrial production of residential buildings and organize the corresponding powerful chains of construction and installation works, engineering preparation of extensive territories for settlement zones development, reconstruction of a transport framework under many times increased intricacy traffic, design and technological equipment of a complex technical system of transportation, installation and finishing of large-sized elements of panel buildings.

This set of tasks cannot be limited to the space of one city, even the largest - for the obvious reason that a number of systems that provided a revolution in urban planning, had a transregional or even all-Union scale – from the union-republican system of typical design to providing the building industry with assembly and transport machines and mechanisms. Even the more important seems to be the task of identifying the real sources of appearing of certain innovations and setting, where possible, the Ukrainian and local, Kharkiv priority in architectural, planning and engineering innovations.

It should be borne in mind that the scale of the phenomenon under study is extremely significant, and its structure and process are marked by a high degree of complexity. Therefore, the realistic goal for this publication is, as noted, to define an approach to constructing a general picture of that, without exaggeration, revolutionary rebuilding of all architectural, constructional, planning and socio-organizational activities which has been unfolded in the process of industrialization of mass housing
development in the country. On the other hand, limiting the tasks of this article by Kharkiv is a conscious and well-considered decision that provides real opportunities to collect empirical material and access the necessary historical sources.

1. The period of mass industrial development in the architectural research

Period of the mass industrial development is widely reflected in the professional literature in the analytical and generalizing works of domestic authors. The works that resonate in the main content are devoted to the achievements of the period under study in scale of the former Soviet Union (Z. N. Yargina [4], Y. V. Kositsky, V. V. Vladimirov [5], V. A. Lavrov [6], V. T. Shimko [7], etc.), as well as the actual Ukrainian experience (M. M. Dyomin, G. I. Lavrik [8, 9], Y. P. Bocharov, G. Y. Filvarov [10], A. M. Pleshkanovska [11], N. M. Gabriel [12], Y. M. Bilokon’ [13], V. I. Nudelman, Y. Y. Klyushnichenko, M. M. Kushnirenko [14]).

Almost all of these studies are characterized by a common planning and urban orientation. The predominance of this view of the epoch, figuratively speaking, "from a bird's eye", had its basis in the socio-political background in which the architectural theory existed and changed. It is easy to see that these texts almost without exception belong to the period of the so-called "perestroika" and the first post-Soviet decade, so they are based on methodological principles and a system of internal guild self-censorship, which has been developed in Brezhnev's time. The lack of research that would link all the significant levels of transformation that has taken place, including issues of economics, technology, research and development, social organization and stratification, etc., stems from the lack of "social order" to identify driving forces, goals, limitations and results of the implemented policy [15]. Maintaining the integrity of the process and the ability to regulate the situation should remain the party-government prerogative.

In this regard, a somewhat separate position is occupied by a textbook for architectural universities "Social Fundamentals of Architectural Design" (authors Z. N. Yargina and K. K. Khachatryants, published by Moscow Architectural Institute, 1990), which quite fully and interestingly reveals the systemic relationship between perspective architectural and city-planning research of that time and experimental-design developments. The nature of typical design, technology of zoning of typical projects and features of their introduction into the building industry are also discussed [16].

Quite naturally, the works devoted to a purely Kharkiv matters do not go beyond the discussion of urban composition (I. O. Alferov, V. L. Antonov, R. E. Lyubarsky [17]) and the historical evolution of urban development (Yu. M. Shkodovsky, I. M. Lavrentyev, O. Yu. Leibfreid, Y. Y. Polyakova [18]). At the same time, names of the real heroes of the era, Ukrainian architects and urban planners of this period – O. I. Zavarov, L. M. Tulpa [19; 20], E. G. Vainshtein, P. N. Nirinberg, L. D. Nivina, A. D. Konsulov and others remain known only to a few living contemporaries, witnesses and participants at the turning point of the 1950's and 1960's.

Over time, with the expansion of industrial development and the accumulation of both positive and critical experience of new urban planning practices, the view at the industrialization of construction has undergone a profound evolution. From an almost magical innovative means of transforming the living environment, the large building industry has gradually gained in the public eyes and in the professional reflexion an image of powerful and rigid, almost spontaneous force, which destroys the traditional urban lifestyle and dehumanizes the living environment. In the public consciousness the stable theme has gradually consolidated – the need to "humanize" the arrays of industrial housing, i.e. to return to the urban environment aesthetic quality and to overcome the socio-psychological alienation, which became to be increasingly associated with the effects of industrialization.

The economic and socio-political crisis of the late 1980s till mid-1990s, the cessation of governmental funding for housing developments, and the subsequent radical transformation of the economic system of Ukraine led to the final decline of the planning strategies and technologies of the large building industry. Under these circumstances, there was no incentive to invest in the study of the course and to record the creative results of the period of mass industrial development. The period, which until recently seemed a heroic era of domestic urban planning, was now perceived as a clear aesthetic
and socio-functional symbol of totalitarianism, which must be overcome and eradicated. The true significance of the architectural and urban heritage of the 1960s - 1980s (as well as their artistic and social heritage) began to loom in just two decades, closer to the mid-2000s, and primarily not in Ukraine but in Western and Central Europe, based on different, sometimes opposite life and professional intentions.

On the one hand, it is time for the creative vanguard of Western architecture to comprehend the experience of more and more frequent contacts with the former world from behind the Iron Curtain. These contacts eventually turned into an uninformed feeling that in the recent wave of fascination with the avant-garde of the 1920s and condemnation of the eclecticism of the 1930s and 1940s, the Western analysts overlooked something big and important in the architecture of the East (and their admiration and repulsion were in fact prepared by pro-modern Soviet researchers and not without sophistication embedded in the minds of Western colleagues). Then it was time for young researchers from the Netherlands and Germany to discover for themselves and for us the ambiguous and therefore even more interesting achievements of the very recent socialist past [21]. A typical example is the book ”Ideals in Concrete” [1], created as a result of a Dutch research expedition to study the environment of large areas of industrial development, which was conducted in a number of major cities in Ukraine and Russia. A comprehensive study of the experience of mass housing construction in the USSR is presented, for example, in the book ”On the way to the typology of Soviet mass housing: a collection in the USSR 1955-1991” [2], which analyses the stages of mass housing development, probably for the first time on the basis of careful factual research.

Another impelling motivation to study the complex, heterogeneous and ambiguous heritage of the period under study arose in the context of the implementation in Germany of a number of large-scale government rehabilitation programs for similar housing estates inherited from the GDR. Since the early 2000s, the influential German magazine “Deutsche Bauzeitung” [22] has been systematically publishing research on the social issues of the architectural environment in the “Social City” series. In these studies the technique of architectural sociology is improved, conceptual principles of social rehabilitation of peripheral areas of big cities of the former GDR are developed, namely for areas of mass industrial building. These concepts also include accommodation programs for groups of residents with different social and property status, ways to intensify participation programs aimed at involving the population in improving their living environment, and so on.

Another, we can say, charitable purpose of these studies is to use the German experience of rehabilitation of industrial buildings for the possible deployment of similar programs in the former Soviet Union. It is also important to assess the practical results of the completed German programs, to find out the economic and social efficiency of the huge investments that were directed to them from the state budget of FRG [23]. Of fundamental interest is an international project initiated by the Karlsruhe Institute of Technology, entitled ”Socialist City an Unloved Heritage?" Within the framework of the project, international research teams, in which scientists and specialists from Germany, Ukraine and the Russian Federation were represented, examined the results of rehabilitation projects in the areas of mass housing development in Berlin, Dresden and Halle-Neustadt. Following the interim results of the first phase of this research project, a number of interesting publications have already been published [3], the project will be continued in the near future.

2. The general innovative character of mass residential development in the 1960s – 1980s

The most important architectural and planning innovations that have been developed during the quarter of the century under study, especially in the largest cities of Ukraine, include the introduction of a microdistrict system with a tiered (“stepped”) system of public service of the population. In the course of this implementation, in which Kharkiv played the role of one of the pioneers, fundamental shortcomings just in the functioning of the service system were revealed (Figure 1). Here Kharkiv city planners played a leading role in creating the method of so-called "focusing", which in the Ukrainian SSR was first used in Kharkiv. We should emphasize the crucial contribution of the architect and urban
planner Leonid Matviyovych Tyulpа [25], the main author of urban concepts and coordinator of design work on the most important residential areas of Pavlove Pole and Saltivka.

Figure 1. Development periods of industrial housing development in the city of Kharkiv (authors’ scheme)

Fundamentally innovative was the activity of Soviet designers at the time in the field of creating typical series of residential buildings intended for mass industrial developments. In this direction, Kharkiv not only implemented and adapted to its technological capabilities a series developed in central and republican design institutions. On a par with them were innovative developments in a series of typical housing projects belonging to the “Kharkivproekt” and “Ukrmistobudproekt” institutes, with the interested participation of Kharkiv house-building plants (HBP).

Direct technological innovations in the period of industrial development were associated in Kharkiv with the creation of high-tech at the time house-building plants DSK-1 and DSK-2, the introduction of vibrating rolling conveyors production of large panels and the transition to fundamentally new flow building technologies. Due to this, the projects of standard series included original technical solutions for the serial production of prefabricated elements, innovations in housing planning decisions and in the structure of neighborhood development (Figure 2, [25]).
Igor Alfiorov  
(1930-1978) architect,  
Chief Architect of Kharkiv (1965-1975).  
Head of the development of the masterplan for Kharkiv (1967)

Victor Antonov  
(1926-2015) Sc.D., architect,  
professor, Chief Engineer of the “Kharkivproject” institute (1956-1967).  
Head of the development of the masterplan for Kharkiv (1964)

Yuri Vorobyov  
(1928-1999) Ph.D., engineer,  
professor, Chief Engineer, later Head of Kharkiv House-Building Plant DSK-1 (1968-1973).  
UkrSSR State Prize Laureate

Oleksandr Gayovyi  
(1926-2008) Ph.D., engineer,  
professor, Chief Engineer of “Kharkivzhytlobud” Combine (1966-1984).  
UkrSSR State Prize Laureate, Honored Builder of Ukraine

Volodymyr Reusov  
(1925-2011) architect,  
professor, Head of the Building Department of the Kharkiv Regional Party Committee (1968-1985).  
Honored Builder of Ukraine

Leonid Tyulpa  
(1922-1994) architect,  
urban planner, author of the projects of the largest Pavlove Pole and Saltivka housing estates.  
Honored architect of Ukraine

**Figure 2.** Architects and engineers, prominent organizers and active participants of mass housing industrial development in the city of Kharkiv.

An important organizational and managerial innovation in Kharkiv, as in other major cities of Ukraine, was the creation of a unified system of building production in the structure of powerful managerial combines ("Kharkivzhitlobud" and "Kharkivprombud" of the Ministry of Industrial Construction of UkrSSR) that were able to effectively coordinate the project-investment cycle, including design and technological equipment, site preparation and implementation of construction on the scale of the metropolis. A significant innovation of the 1970s in the management and coordination of design
and construction was the transition to the creation of so-called City Planning Complexes as an enlarged basic unit of planning and implementation.

Innovative for the former USSR neighbourhood system was the culmination of a long and quite dramatic history of invention, multiple correction and implementation of this concept. This story spanned the entire first half of the twentieth century and unfolded in a number of developed countries in Europe and North America. It consisted of numerous and significant events in the social and architectural-urban thinking of the era and in construction practice. These include the well-known concept of the "Garden City" belonging to the Englishman Ebenezer Howard (1850-1928) [26], its modification in American housing in the 1920s, known as the program of "big quarters" [27], sociological analysis and critique of this practice by representatives of the Chicago School of Sociology [28], conceptual development and large-scale organizational, design and construction practice of Patrick Abercrombie (1879-1957), in particular in the project "Greater London" [29], and a significant number of repetitions, improvements and modifications of these samples almost all over the civilized world. But the completion and the most large-scale and consistent application of the microdistrict system was acquired in Soviet republics and in countries that aspired to a socialist orientation – on both sides of the "iron curtain". In a sense, these Soviet practices were the culmination and highest point of development of an entire era in world modernist urbanism [30].

3. New housing estates of Kharkov - experimental site of architectural and urban innovation

In the Ukrainian practice of industrial urbanism, a fundamental innovative step was taken in the development and implementation of the project for Pavlove Pole residential district in Kharkiv (since 1956, architects O. G. Krykin, L. M. Tyulpa and I. Ya. Feigin) – the first residential array on the free territory, designed for construction products of house-building plants [31]. The connection between the planning schemes in the design of the Pavlove Pole district and the nature of the construction industry in the form of newly established enterprises of conveyor production of residential and later social facilities was also innovative. In particular, the composition of the dotted buildings of the array was brought to life by the use as a basic planning unit of large-panel buildings – completed industrial products. Smaller architectural and planning innovations include the method of blocking buildings, which was first used also in Kharkiv, on Pavlove Pole (Figure 3, [32]).

![Figure 3. Panorama of Pavlove Pole housing estate](image)

Further search for more diverse opportunities to block houses prompted Kharkiv designers to improve the typology of large-panel buildings, stimulated the evolution of interior planning, development of a new typology of sections and stair-lift units, more flexible in terms of combinatorial urban planning capabilities. The use of various methods of blocking buildings marked later a departure
from the original principle of the finished construction product like the whole house and provided a transition to more complex, variable and plastic ways of organizing the three-dimensional structure of the neighbourhood.

Detailed planning of residential areas using the method of "focusing" (Figure 4, [24]) for the first time in the USSR was developed in Kharkiv during the construction of Saltivka – the largest housing estate in Ukraine and in the former USSR (over 400 thousand inhabitants) (Figure 5, [32]). The method was based on the concentration of socio-cultural, commercial and consumer services in the vicinity of public transport stops and big connection hubs, with the appropriate calculation of accessibility radii. The "focusing" system made fundamental adjustments to the microdistrict neighbourhood system and practically eliminated the "first stage" of the service system within the microdistrict as a planning principle. Making these adjustments to the ideology and practice of microzoning was recognition of the principle of human mobility in the modern city and the actual rejection of the basic binding of the service system to the place of residence.

![Figure 4. District no 602 in the structure of Saltivka housing estate. Project.](image-url)
Typological innovations can be found in the development of Kharkiv's own series of industrial housing. These design developments of “Kharkivproekt” and “Ukrmistobudproekt” project bureaus coexisted with the optimization approach, which prevailed in the adaptation and partial improvements of the "all-Union" series, in particular in the work on the II-57 series, the basic for the DSK-1 house-building plant.

Technical and technological innovations are concentrated in the creation and cyclical modernization of the production of vibro-rolled panels, much more economical compared to frame-panel structures. Three BPS-6 vibro-rolling mills were installed at Kharkiv DSK-1 the first house-building plant in Ukraine. Undoubtedly innovative was the transition to the conveyor technology for the production of large panels and the corresponding current technology of installation of finished houses. Innovations in the technological processes of production and processing of assembly units were largely focused on finding ways to maximize the displacement of wet processes. Much effort, in particular, has been put into the implementation of sanitary cabins of full factory readiness.

Mass industrial housing construction allowed Kharkiv to eliminate the housing crisis around the mid-1980s. At this time, the city has reached a housing rate of 21.0 m² per capita. This figure, which is comparable to the European average, is still maintained in Kharkiv.

Innovative methods of designing and implementing mass construction were dictated by the shift of a unique historical situation, which stretched from the beginning of the Khrushchev’s "thaw" to the end of the period of "stagnation" in the late Brezhnev’s time, and, accordingly, by the action of a number of motivating factors. Among them, the leading role was played by the well-known and repeatedly mentioned by the bad word centralization and total nationalization of closely interconnected systems of the construction industry and typical architectural and urban planning. The privatization of the housing stock created in those years served as a kind of "airbag" for a large segment of the urban population in the following decades.

At the same time, the very specific nature of architectural and urban planning innovations of the period between the 1960s and 1980s led to a number of problems and difficulties associated with the today’s functioning and technical maintenance of the then created housing estates and complexes. Sober analysis and unbiased assessment of the achievements and failures of the era of mass industrial development is an important and relevant task for Ukrainian architectural science, especially against the background of the obvious shortage of new ideas and positive programs in today’s urbanism.
Conclusions

Mass industrial residential development of the late 1950s - early 1980s, which radically changed the face of modern Ukrainian city, only in recent years has become the subject of complex historical and architectural research. Kharkiv, the first capital of Ukraine, the second largest and most significance city in the country, represents a fertile field for such an analysis. Here remained crowded, Europe’s largest arrays of large-panel buildings, not only fully functioning, but also continuously growing. Here is still available a historical evidence of how, over the course of a quarter of a century, a unique and highly productive design and production order has emerged, flourished and faded away, and in general ensured the successful implementation of a complex set of innovative and modernization measures.

The scope and specificity of the subject of these studies should be correlated with corresponding research approaches. The experience of the contact with the reality of the coup of the 1960s - 1970s allows researcher to outline their main characteristics:

- Multidisciplinary, dictated by the close interconnection of purposeful changes carried out on different "floors" of urban development – from technical re-equipment and the creation of a new large building industry to a radical breakdown of architecture and urbanism thinking and to profound changes in the style of urban life.

Not only relevance, but also extreme urgency. Each year, it is becoming increasingly difficult to record the content and interconnection of events that are rapidly fading into the past, together with their participants and eyewitnesses, technical archives and huge factories. The urgency of a completely different plan is due to the fact that the gigantic volumes of large-panel development that have arisen with lightning speed now promise as quickly to enter the period of complete moral and physical depreciation. Kharkiv, like most large post-Soviet cities, is facing a period of forced intensive reconstruction of modernist sleeping areas.

The style of research needed in this context should be fundamentally different from the usual style of architectural and historical discourse. Its focus is not so much on architectural and urban morphology, not even on its functional patterns, but the meaning and structure of the transition situation, on the means to ensure a successful socio-technological breakthrough and ways of disposing of obsolete material objects and behavioral stereotypes.

Finally, the research of Kharkiv era of mass industrial development should solve the same problem with respect to the 60s - 80s as unfolded in recent years studies of the heroic era of the avant-garde of the 20s and 30s. The matter is to return to studies of Modern architecture the real historical scale of those architectural and urban innovations that took place in Ukraine in the amazing 20th century.

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