Chapter 26
Optimizing Urban and Social Planning Structures in Medium-Sized Cities: Lessons from Uzhhorod for Postwar Reconstruction in Ukraine

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1 Introduction

In the aftermath of the war in Ukraine, the landscape of the country will have undergone a significant transformation. As the country embarks on the challenging journey of postwar reconstruction, it is imperative to address the complex issues that have arisen, particularly within urban areas. The high rates of urbanization that prevailed prior to the conflict have exacerbated the challenges facing urban systems, and these complications are especially acute in medium-sized cities (Russo & Cirella, 2017, 2020). Medium-sized cities across Ukraine exhibit a remarkable diversity in typology within the broader category of populated cities. Yet, they share a multitude of common features, including their functions, ways of life, and the economic and social problems they confront. However, as the process of postwar reconstruction unfolds, it becomes evident that one of the central issues hindering the development of these medium-sized cities lies in the proper social and planning organization of these urban centers. This challenge is not unique to Ukraine, nor is it confined solely to medium-sized cities. It stems from a failure to adequately account for historical traditions, social aspects, and the habits of the population when formulating general plans for urban development (Nocca, 2017;

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Capolongo et al., 2018; Semeraro et al., 2021; Kühner et al., 2021; Zhang et al., 2023). Furthermore, overlooking the unique nature of the terrain and existing buildings has resulted in significant disruptions to the functional evolution of these cities and their interconnected systems (Hummel et al., 2020; Vangeli et al., 2022; Liu et al., 2022; Castaño-Rosa et al., 2022; Xu & Chopra, 2023). The repercussions of this oversight are most keenly felt in the socio-planning structure of these cities, which shapes the environment in which residents interact and meet their daily household needs (Prior & Harfield, 2009; Wilkerson et al., 2018; Latham & Layton, 2019; Zanganeh Shahraki et al., 2020; He et al., 2021). In the wake of the conflict, there is an urgent need to rectify these planning problems to create urban spaces that are not only functional but also foster a sense of community and well-being among the residents.

One critical aspect of the postwar reconstruction effort is to integrate the historical heritage and cultural identity of these cities using new urban plans. This will not only honor the past but also contribute to the unique character of each medium-sized city. Additionally, the reconstruction process should prioritize sustainable urban development practices (Cirella, 2020; Oniszczuk-Jastrząbek et al., 2020; Cirella et al., 2020; Fu et al., 2022), which can mitigate the environmental impact of urbanization and promote resilience in the face of future challenges (Cirella et al., 2007; Cirella & Tao, 2008, 2009a, 2009b; Cirella & Zerbe, 2014; Hrelja, 2015; Albrechts et al., 2016; Bibri & Krogstie, 2017; Nae et al., 2019; Russo & Cirella, 2019; Faria de Deus et al., 2023). As Ukraine rebuilds and revitalizes its urban areas, it must recognize that proper socio-planning organization is not merely a technical concern but a fundamental aspect of creating cities that are not only functional but also nurturing, vibrant, and resilient in the face of the uncertainties that the future may hold. In doing so, Ukraine can emerge from the shadows of conflict with cities that serve as beacons of hope and progress for its citizens.

2 Enhancing Urban Development in Medium-Sized Ukrainian Cities: A Postwar Perspective

In many of Ukraine's medium-sized cities, the urban landscape is marked by a notable clustering of crucial public institutions in their central cores, while public service hubs within residential neighborhoods remain noticeably underdeveloped, falling short of adequately addressing the essential needs of the local population. Recognizing the pressing need for enhancing the social and planning structure of medium-sized cities, particularly by respecting the unique customs and traditions of their inhabitants (Wilkerson et al., 2018; Latham & Layton, 2019; Barrado-Timón et al., 2020; Zanganeh Shahraki et al., 2020; Escalona-Orcao et al., 2021; He et al., 2021), the following chapter seeks to formulate effective methods for this improvement. To advance this overarching goal, a comprehensive set of five research objectives has been formulated in a post-conflict context. (1) Analysis of the
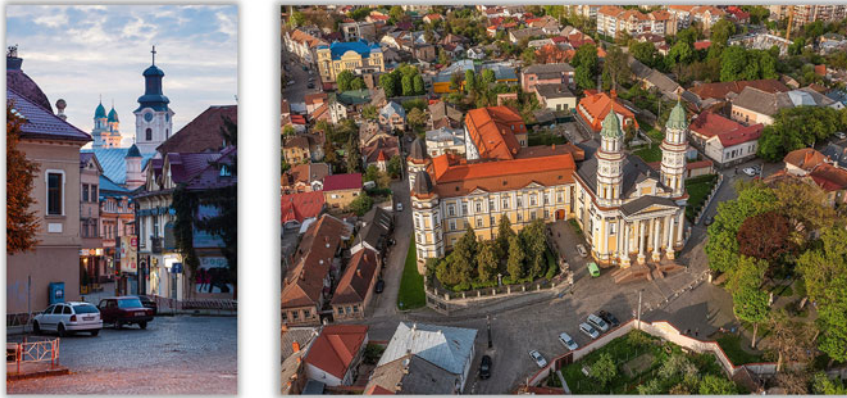
Fig. 26.1 Uzhhorod: (*left*) old town and (*right*) aerial view of Uzhhorod Cathedral [Source: (*left*) Photograph published by Moahim from Wikimedia Commons, October 15, 2014; (*right*) photograph published by Ekaterina Polischuk from Wikimedia Commons, May 6, 2021]

socio-planning structure: The first key research objective involves conducting a thorough examination of the socio-planning structure prevalent in medium-sized cities. By focusing on a specific example, such as Uzhhorod, we aim to gain insights into the existing urban framework, identifying its strengths and weaknesses. (2) Analysis of public service network formation: The second research objective centers on the analysis of the formation and structure of the public service network within the city. Understanding how these services are organized and distributed is crucial for devising effective strategies for improvement. (3) Development of information model: A pivotal aspect of this research is the creation of an information model that encapsulates the socio-planning structure of medium-sized cities. This model will serve as a valuable tool for visualizing and comprehending the complex web of factors influencing urban organization. (4) Identification of principles and typologies: Another critical research objective involves identifying the fundamental principles underpinning the socio-planning structure. As such, the chapter aims to develop models and classifications that facilitate the categorization and understanding of different typologies within this structure. (5) Analysis of optimization methods: The final research objective involves an analysis and evaluation of methods for optimizing the existing socio-planning structure of the city (Fig. 26.1).

Drawing from both domestic and international experiences in urban design and reconstruction, this step seeks to identify best practices and innovative solutions to address the deficiencies within the current urban framework. In sum, since this chapter aspires to contribute to the enhancement of postwar medium-sized cities in Ukraine, respecting local traditions, analyzing existing structures, and drawing upon global expertise, will aid in creating a blueprint for the country's future urban development. This will also harmonize with the unique identities and needs of these cities' populations, ultimately fostering more inclusive and resilient communities.

In addition, the primary urban planning task in establishing a well-developed and comprehensive network of public services encompasses several key elements. These include the effective spatial organization of community centers within the city system, the judicious placement of residential areas, employment hubs, and service centers, and the optimization of population density to ensure efficient resource allocation for the community's needs. To avert further deterioration of the urban environment and facilitate the harmonized advancement of all urban systems, it is vital to consider each constituent element within the broader context of urban development challenges. The rational spatial organization of public services demands a systematic delineation of the urban landscape, interwoven with careful planning. Currently, the division of most Ukrainian medium-sized city neighborhoods remains somewhat arbitrary and fails to align with established state building codes (State Building Standards of Ukraine, 2001, 2019). This misalignment poses a significant impediment to these cities' rational growth and development.

In recent years, transformations in employment structures have been profound, driven by evolving societal needs, the diversification of economic activities, and the shift toward new economic paradigms within the state's economy (Horodyskyy, 2021; Zakharchenko et al., 2021; Mulska et al., 2022; Vasyltsiv et al., 2022; Malyarenko & Kormych, 2023; Arndt et al., 2023). Hence, this ever-evolving landscape emphasizes the inherent inadequacies within the urban development documentation approach, with a specific focus on the unique challenges posed by medium-sized cities. What is urgently required is a more sophisticated and customized approach that can flexibly adapt to the distinct circumstances at play, particularly in the postwar context. This is of paramount importance as we anticipate input and perspectives from both Ukrainian and foreign experts and managers, each offering their invaluable insights and experiences. In such a dynamic environment, a versatile and responsive approach to urban planning becomes not just advisable but imperative for ensuring the successful and harmonious reconstruction and revitalization of the country. At length, what matters most for these cities is not an overly rigid parameterization of the spatial configuration of public centers at various levels, but rather the establishment of overarching principles and guidelines for functional-territorial optimization (Talen, 2000; Wojnarowska, 2016; Blazy & Łabuz, 2022; Şahin Körmeçli, 2023; Xiang et al., 2023). Therefore, the complex and multifaceted nature of this challenge, as discerned through both domestic and international research and practice, dictates a more profound exploration and an expanded investigation of the socio-planning structure as a fundamental determinant of urban development. Only through a comprehensive understanding of this structure's dynamics can we hope to surmount the complexities and intricacies involved in fostering sustainable and prosperous medium-sized cities for Ukraine's future, even in the wake of the COVID-19 pandemic (Kahraman et al., 2022) and the ongoing conflict within the country. In this evolving landscape, where resilience and adaptability are paramount, a holistic understanding of urban planning and its socioeconomic dimensions is crucial for charting a prosperous path forward.

The examination of this issue is made possible through advancements in various domains, including systems analysis theory, urban planning theory, spatial planning,

and information technology. In the realm of contemporary science, several primary avenues have emerged to tackle these challenges. The most prevalent approach involves the comprehensive study of urban development, incorporating geographical, socio-demographic, and urban planning considerations. This multidimensional perspective has been the focus of numerous Ukrainian scholars, including Gabrel (2002), Golyk (2004), Bezlyubchenko et al. (2006), Demin (2010), and Bilokon (2021). Beyond national borders, researchers like Install (2000), Albrechts et al. (2016), Saaty and De Paola (2017), Delitheou et al. (2019), and Cirella (2022) have dedicated their work to this issue. Specifically concerning urban centers, the challenges of urban planning within city cores have been examined by scholars such as Buhaug and Urdal (2013), Miller (2013), Gemeda et al. (2023), and Tsegay et al. (2023). Moreover, the application of a systematic methodology is exemplified in the research conducted by Kukuła and Lublin (2016), Dyomin et al. (2021), Bulakh et al. (2022), Davydenko et al. (2022), Otrishchenko (2022), and Grum and Kobal Grum (2023), as well as scholars like Vadimov (2018) and Ladigina and Rudenko (2020), who have explored the intricacies of social settlement infrastructure formation.

Internationally, similar inquiries have been undertaken by Jaakkola and Alexander (2014), who have grappled with issues related to service system formation, while Hutton (2003), Polese et al. (2018), and Qiu and Wang (2022) have also contributed to the discourse on these matters abroad. In all, the findings of this research have various practical applications, including (1) assessing socio-planning structures and spatial organization of public services, that is, to evaluate the socio-planning structure of cities and regions, as well as to explore optimization possibilities for the spatial arrangement of public services; (2) evaluating functional zoning in urban and regional master plans, that is, to assist in the assessment of different functional zoning options within urban and regional master plans, providing insights into how these plans can be optimized; and (3) guiding the formation of public service networks for strategic urban development in the postwar period, that is, to inform the development of public service networks, aiding in addressing strategic development challenges within urban systems during the reconstruction phase. Finally, these results also build upon prior research in urban planning and spatial planning from the last century, encompassing various aspects such as the evolution of the concept of social planning structures, including their current state and developmental trends (Wood, 1944; Troub, 1982; Bromley, 2003; Black & Steiner, 2021); the examination and classification of population needs within urban contexts (Brenner & Schmid, 2014; Serra et al., 2018; Balk et al., 2018; Terama et al., 2019; Goncharuk & Cirella, 2020; Moreno-Monroy et al., 2021; Cirella et al., 2021; Spring & Cirella, 2022); and the status and challenges associated with the modern methodology of system analysis in urban planning (Geyer et al., 2014; Pourmohammadi, 2022; Lehmann, 2023; Pérez-Martínez et al., 2023). To enhance the clarity of the concepts discussed in this chapter, an information model should be considered, as noted by Wilson (1968), Bojić (2018), Alexander (2022), and Reid and Wood (2023). This model encapsulates the socio-planning structure of medium-sized cities, characterized by three essential components: population, territory, and service facilities.

3 Uzhhorod: Case Study of a Medium-Sized City

3.1 *Layout of the City*

Following the war, enhancing the social planning structure became increasingly vital, demanding a highly coordinated strategy for postwar reconstruction. The optimization of the social planning structure should center on a well-organized approach to social and domestic service facilities, which, in turn, depend on the rational organization of urban territories. As such, in order to assess the efficiency of territorial organization in medium-sized Ukrainian cities, an in-depth analysis of Uzhhorod's public services was undertaken from 2018 to 2021 as a sample city (Fig. 26.2). An examination of the findings revealed a complex interplay of connections between established service centers. Notably, rural centers lacked clear demarcation, and the structural coherence of certain areas was fragmented. Furthermore, the distribution of service hubs displayed discrepancies, with certain areas experiencing an undue concentration or enlargement of these facilities. Residential clusters primarily comprised sporadic and isolated service elements, while a spontaneous clustering of service nodes occurred in specific sections of main thoroughfares, residential neighborhoods, or at the intersections of public transportation routes.
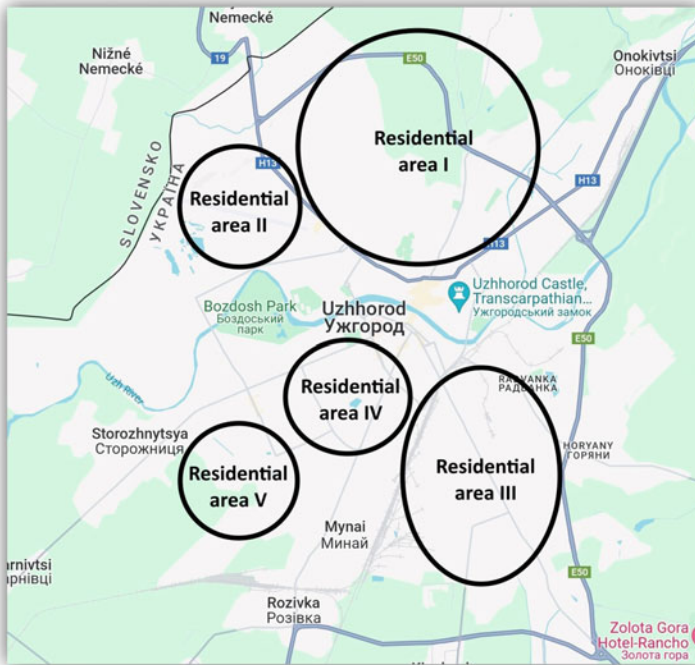

Fig. 26.2 Map of Uzhhorod: (right) residential and surrounding areas and (left) layout and zoning of the city borders [Source: Google Maps (2023)]
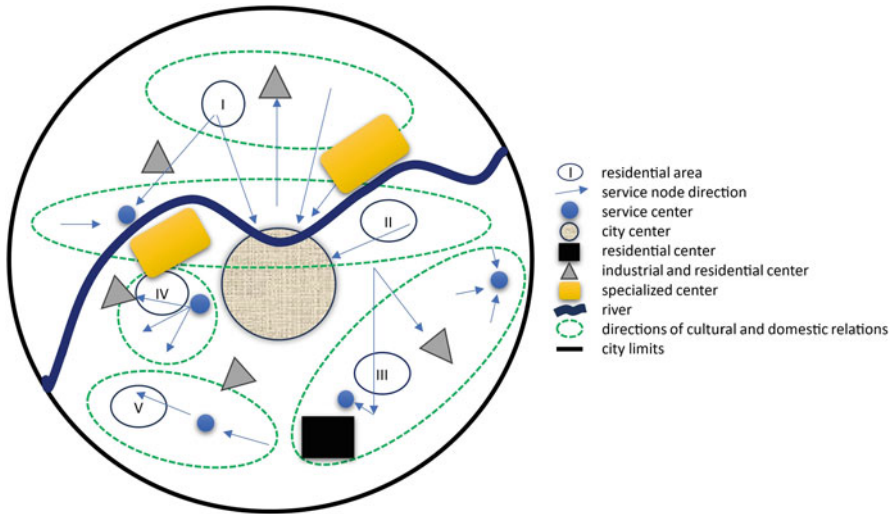
Fig. 26.3 Model of organization of the city center and residential areas according to Master Plan of Uzhhorod (Bilokon, 2021). The city is interconnected through service nodes facilitating citywide and inter-residential area connectivity and mobility

When we examine the traditional, historically stable planning model from a social perspective, it becomes evident that the alignment between cultural and residential elements in Uzhhorod does not correspond to the existing zoning. The majority of public service centers in residential areas tend to cluster around the city center, creating a disproportionate demographic burden on the central district (Fig. 26.3). Furthermore, these primary service centers remain inadequately developed, with predominantly sporadic individual service elements scattered throughout the city. Spontaneous concentrations of service nodes have emerged in specific areas, often at the junctions of main thoroughfares, residential neighborhoods, or public transport intersections (Cirella et al., 2019; Pont et al., 2021; Mouratidis, 2021).

To avert further degradation of the urban environment and establish mechanisms for the synchronized development of existing subsystems, it is essential to consider each essential urban component, including cultural establishments and community centers, within the broader context of urban development. Pre-project analysis serves the purpose of delineating the available resources and pinpointing the challenges in constructing a network of centers. The efficacy of addressing these challenges hinges on both the utilization of existing structures and the specific architectural and urban planning objectives (Demin, 2010). Historically, city community centers, housing administrative, public, and commercial institutions, have served as central anchors within the city's planning structure. These centers have not only shaped the city's layout but have also played a significant role in determining its developmental trajectory. Without them, the city would risk fragmentation into isolated zones lacking a cohesive planning framework (Gabrel, 2002).

In recent decades, the public service landscape in Uzhhorod has undergone profound transformations. The city's rapid expansion, especially in its peripheral areas, has led to a significant increase in housing construction. However, the peripheral centers of these new residential areas have struggled to keep pace with the growing demand. Conversely, the older districts of the city present a separate set of challenges. Here, irregular planning structures, a dense and outdated street-road network, and the obligation to preserve architecturally valuable buildings have created a mismatch with modern urban planning requirements. This complex situation places significant constraints on resolving these disparities, restricting possibilities and endangering the centuries-old urban fabric—something common throughout European cities (Papageorgiou, 2015; Abyzov, 2019; Grebtsova et al., 2021; Zhang et al., 2022; Campfens et al., 2023; Ko_sciejew, 2023). Moreover, recent decades have witnessed notable shifts in the number and locations of labor and cultural hubs. The city has seen a gradual increase in employment in management, services, and business sectors (Lewandowski & Cirella, 2022), which tend to concentrate in the central zones of the city. Industrial areas, once the primary focus of labor, have seen a decline, and new employment opportunities have emerged, driven by the growth of tourism, recreation, and service sectors.

3.2 Services Facilities in the City

At present, Uzhhorod boasts an extensive network of institutions and service enterprises. Generally, the city's service infrastructure is deemed satisfactory, with some networks even exceeding demand. Detailed information on the principal existing institutions and service enterprises, along with their capacity compliance with regulatory requirements, is provided in Table 26.1 and Fig. 26.4. This data is sourced from the Master Plan of Uzhhorod (Bilokon, 2021). The surplus in service

Table 26.1 The general level of service facilities in Uzhhorod, 2021

| Institution or service enterprise	Unit measurement	Actual capacity	Needed for regulations	% to norms
Secondary schools	Number of places	15,827	13,400	118.1
Children's preschools	Number of places	3390	3574	94.9
Clinics	Number of places	4047	2796	144.7
Trade establishments	m^2 area	172,535	26,795	+6.4
Athletic facilities	m^2 area	8300	11,417	72.7
Catering establishments	Number of places	28,197	4660	+6.0
Markets	m^2 area	6300	4660	135.2

Source: Master Plan of Uzhhorod (Bilokon, 2021)
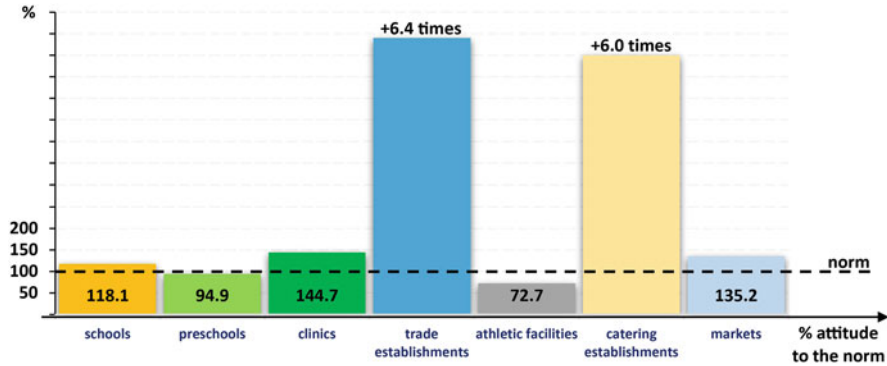
Fig. 26.4 The general level of provision of service facilities in Uzhhorod, 2021 [Source: Master Plan of Uzhhorod (Bilokon, 2021)]

facilities can be attributed to their utilization by residents not only within the city but also from Uzhhorod district and Zakarpattia region.

Moreover, regarding the availability of service facilities in residential areas, there exists a significant disparity, as indicated in Table 26.2. Some residential areas enjoy an excess of these facilities, while others have a severe deficiency in adequate services altogether. Consequently, despite the overall satisfactory provision of cultural and household services within the city, the quality and level of services received by the residents of Uzhhorod vary widely. The most challenging situation is observed in residential area III, where the provision of service facilities falls significantly below the required standards. As such, this discrepancy in service facility provision in residential areas is visually represented in Fig. 26.5. Furthermore, the spatial organization of service networks is presented in Fig. 26.6. These figures highlight that the coverage of service facilities does not encompass all residential areas, indicating that the city's territory is not fully served.

3.3 Detailed Analysis of Educational Institutions, Trade Establishments, and Health Facilities

3.3.1 Research Methodology: Fieldwork, Attendance Patterns, and Zone of Intense Attraction

To conduct a more detailed analysis of this case study, fieldwork was carried out to track attendance dynamics at educational institutions, trade establishments, and healthcare facilities in Uzhhorod between 2018 and 2021. The fieldwork comprised of oral surveying, that is, short on-the-fly interviews, with city residents; a total of 1543 respondents made up the sample size. The choice of these specific types of institutions or service enterprises for analysis is driven by the fact that not all

Table 26.2 The general level of provision of service facilities in each residential area in Uzhhorod, 2021

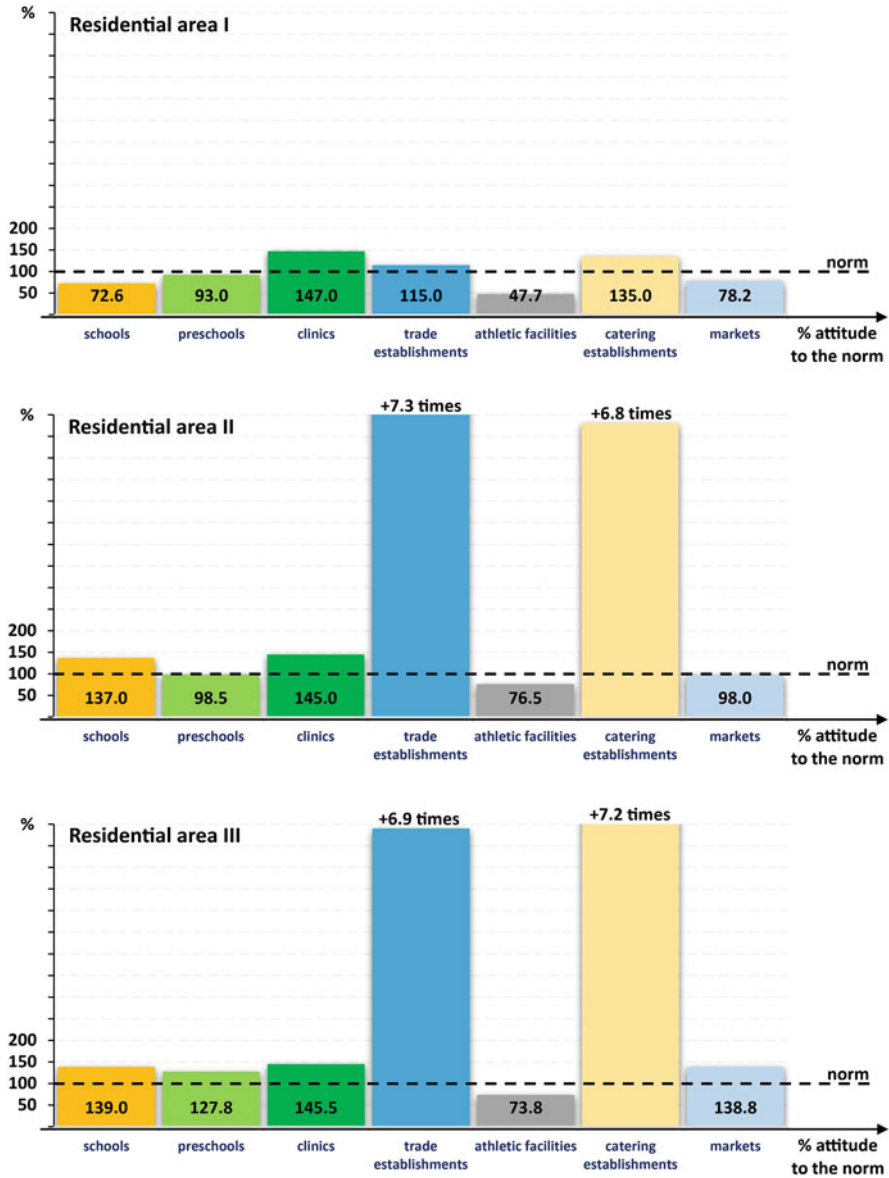| Institution or service enterprise	Normative value	Existing value (% in terms of the normative value)				
		Residential area I	Residential area II	Residential area III	Residential area IV	Residential area V
Secondary schools	Number of places per 1000 students					
	1000	706	648	429	2022	748
		(72.6)	(139.0)	(71.5)	(137.0)	(119.8)
Children's preschools	Number of places per 1000 children aged 1–6 years					
	850	792	758	486	1195	776
		(93.0)	(127.8)	(57.2)	(98.5)	(96.3)
Clinics	Number of patient places per 1000 inhabitants					
	24	590	672	350	1040	780
		(147.0)	(145.5)	(97.7)	(145.1)	(117.0)
Trade establishments	m^2 area per 1000 inhabitants					
	280	5377.4	37,287.6	25,449.2	61,115.6	45,147.2
		(115.0)	(+6.9)	(+6.1)	(+7.3)	(+5.8)
Athletic facilities	m^2 area per 1000 inhabitants					
	70	557.6	997.0	584.1	1601.1	1726.1
		(47.7)	(73.8)	(56.0)	(76.5)	(88.7)
Catering establishments	Number of places per 1000 inhabitants					
	40	902	5558	1788	8133	6894
		(135.0)	(+7.2)	(+3.0)	(+6.8)	(+6.2)
Markets	m^2 area of retail space					
	24	320	640	930	700	560
		(78.2)	(138.8)	(+2.6)	(98.0)	(85.0)

Fig. 26.5 The general level of provision of service facilities in each of the five residential areas in Uzhhorod, 2021 [Source: Master Plan of Uzhhorod; Bilokon, 2021]
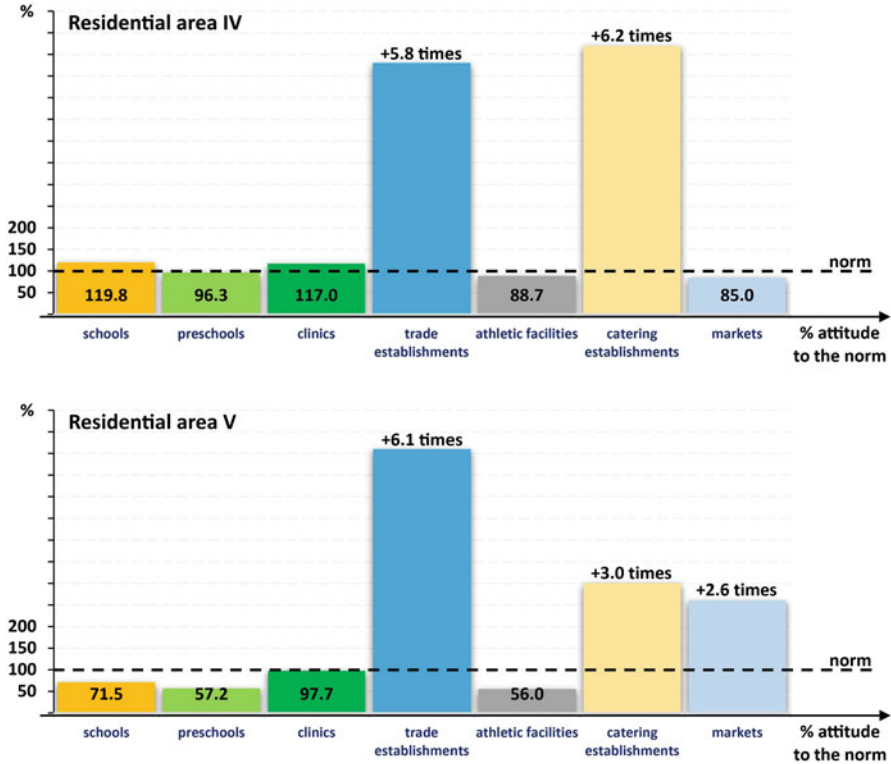
Fig. 26.5 (continued)

networks and establishments play an equal role in shaping the city's character. Among them, education, trade, and healthcare institutions exhibit the highest degree of interactivity within the city. Conversely, cultural and sport institutions and consumer services networks display comparatively lower levels of activity. The oral surveying encompassed inquiries related to the primary criteria influencing the selection of specific service facilities, that is, by asking people what services and facilities they used and what residential area they lived in. This information was recorded using field notes.

Additionally, to better comprehend the attendance patterns, approximated curves were applied to the findings. Using approximated curves can be helpful for several reasons: simplification, ease of interpretation, computational efficiency, and modeling and future prediction (Solomon & Stephens, 1978; Ryu & Slottje, 1996; Kouibia & Pasadas, 2002; Durrleman et al., 2008). That being said, the patterns can be used to estimate future behavior or make decisions based on the data and provide a standardized way to assess and contrast data trends. In this analysis, the approximated curves show a more practical representation of the attendance pattern for the various public service institutions. The curves are described as $y = f(d)$, which can
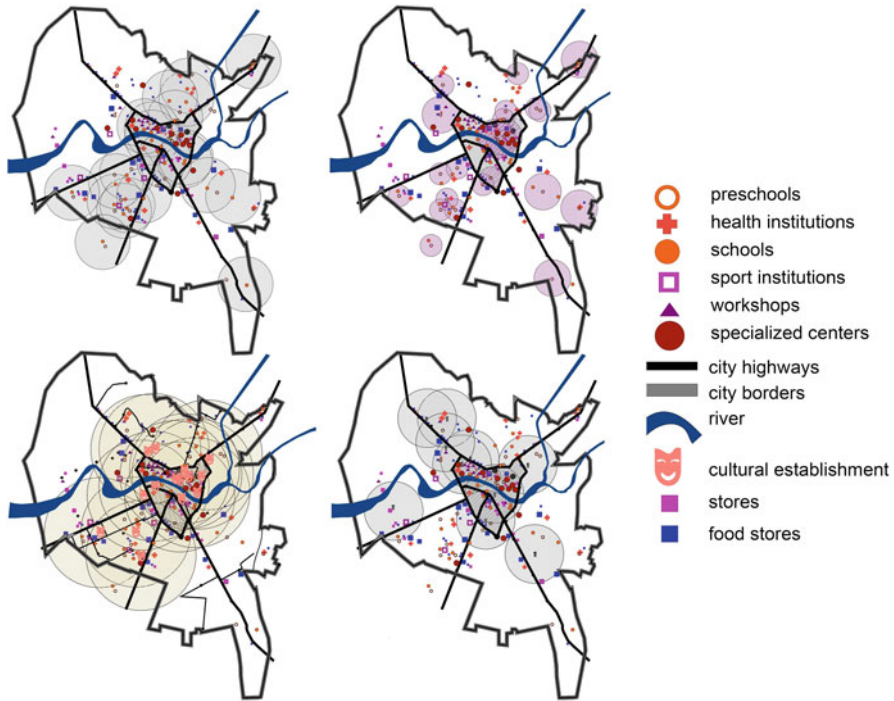
Fig. 26.6 Spatial organization of service networks in Uzhhorod, 2021: (*top left*) network of secondary schools, (*top right*) network of children's preschools, (*bottom left*) network of cultural establishments, and (*bottom right*) network of catering establishments [Source: Adapted from the Master Plan of Uzhhorod; Bilokon, 2021]

be approximated using the following relationship (Dashkevich, 2012), that is, Eq. 26.1.

$$y = \frac{1}{a \cdot d^{2.5} + b_{\max}}$$

(26.1)

where a = the coefficient characterizing the rate of demand change concerning distance (i.e., a larger a results in a flatter graph and a less pronounced zone of strong attraction), d = the distance to the service point, and $b_{\max}$ = the maximum percentage of the population utilizing services within the accessibility radius.

Moreover, the "zone of intense attraction" denotes an area marked by increased activity. The allocation of this zone holds significant practical importance as it influences the composition of the population that shapes the estimated capacity of service facilities and the criteria for their placement within the urban planning framework of communities (Durrleman et al., 2008; Sypion-Dutkowska & Leitner, 2017; Wang et al., 2023). A comprehensive understanding of the occurrence and characteristics of these intense attraction zones is elaborated by Demin (2010).

3.3.2 Results

The findings reveal an uneven demand for various educational institutions within the city. The patterns of attendance at preschools and schools in different parts of the city exhibit variations. In this case, the radii of the zone of intense attraction vary across different service categories, that is, between preschools and schools, and are contingent on the frequency of visits to these institutions (Fig. 26.7). Additionally, it is noteworthy that the service area size for such institutions is not solely contingent on the institution's physical size; rather, a direct correlation is observed mainly in densely populated areas. As such, on average, approximately 45% of the city's youths attend elementary and high schools located in close proximity to their residences. Contrariwise, in the city's outlying areas, this percentage is notably higher, while in the central part of the city, it ranges from 68% to 72% (Fig. 26.8).
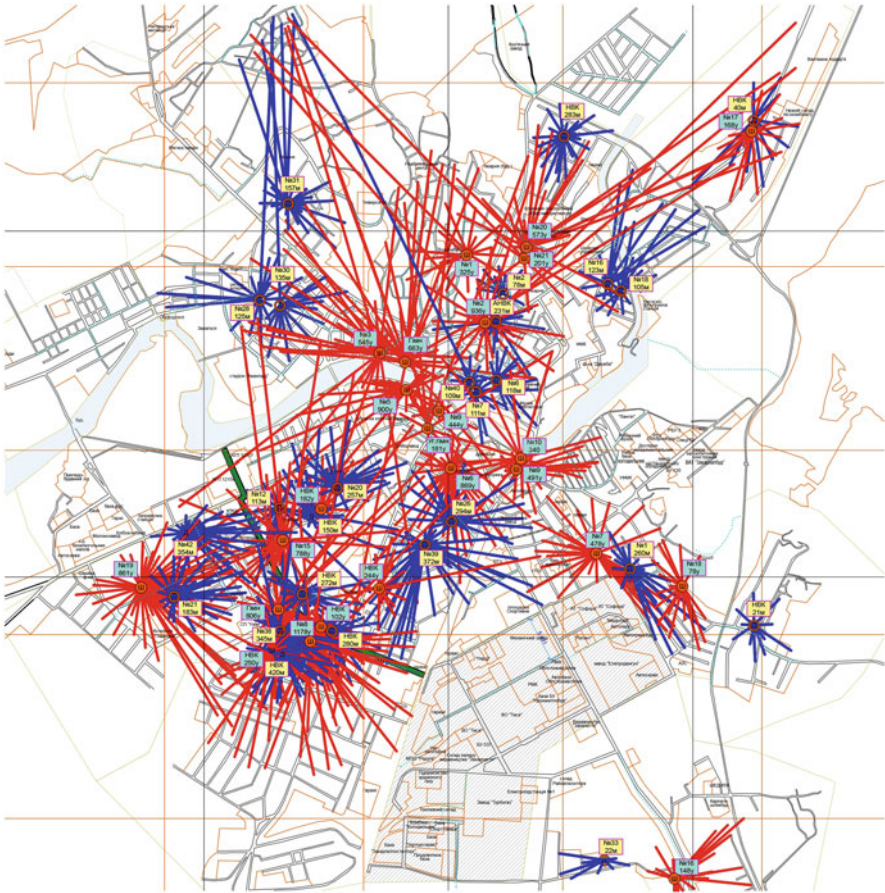

Fig. 26.7 Location and areas of influence of educational institutions: (blue) preschools, (red) elementary and high schools
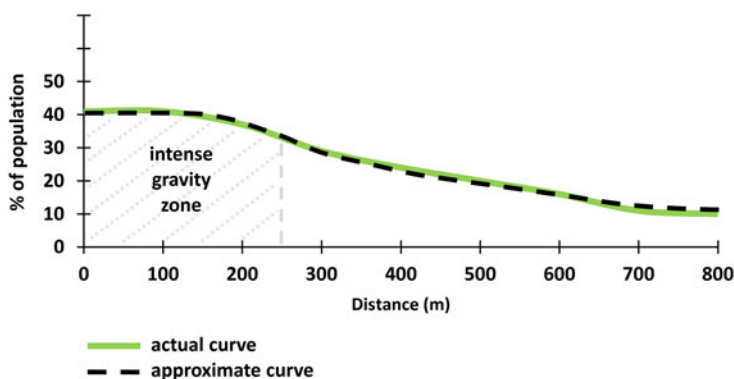
Fig. 26.8 Variation in elementary and high school student distribution in Uzhhorod based on distance: actual curve versus approximated curve

The principal factors contributing to the unequal demand for different educational institutions are rooted in the city's historical and demographic characteristics. The presence of schools offering instruction in Hungarian and Slovak languages, along-side various lyceums and gymnasiums with specialized subject curricula, significantly influences the level of demand for each institution. Accordingly, the popularity or lack thereof of specific institutions emerges as a significant driver of population migration, with migration patterns adapting to the preferences of the local population.

In contrast, the demand for trade establishments generally adheres to the traditional attendance model. Notably, 44% of respondents opt for the services of their nearest supermarket store (Install, 2000; Northamptonshire Country Council, 2013). It is worth noting that the functioning of the city's retail establishment network possesses distinct characteristics. A significant portion of the population, that is, 30% of respondents, continues to utilize retail services regardless of distance. This trend can be attributed to the city's relatively small geographical area, which fosters high population mobility (Pleshkanovska, 2005).

On the other hand, the demand for healthcare facilities exhibits deviations from the conventional attendance pattern. The availability of new options such as private clinics has influenced how residents seek healthcare services (Kis, 2012). In the case of pharmacies, attendance patterns are influenced by social preferences, particularly a flexible customer service system (Fig. 26.9).

As a result, the characteristics of these curves signify that when determining the fundamental parameters of the service network, the primary consideration is the population directly contributing to the establishment of zones of intense attraction. This particular demographic segment, comprising roughly 40–48% of the local population, holds a key role in shaping service network planning. As shown in Table 26.3, the defined boundaries of the zones of intense attraction for the different service categories are provided alongside the percentage of population that
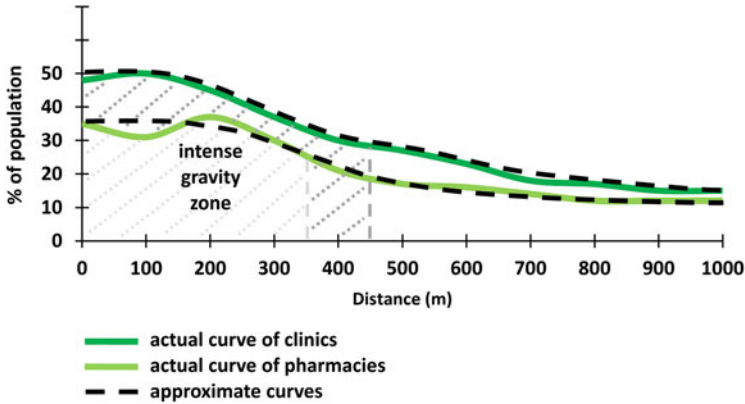
Fig. 26.9 Variation in healthcare facilities distribution in Uzhhorod based on distance: actual curves of clinics and pharmacies versus approximated curves

Table 26.3 Analysis of attendance patterns for public service facilities across various service categories in Uzhhorod

Category of service	Radius of the zone of intense attraction (m)	Percentage of population that participates in the formation of the zone
Educational institutions	250	40–45
Trade establishments	250	40–45
Clinics	450–500	45–48
Pharmacies	300–350	35–40

participates in the formation of the zone (Pleshkanovska, 2005). However, it is important to note these values with a degree of caution as they were derived through unverified experimental research.

By incorporating data regarding the percentage of the population contributing to the formation of these zones, it becomes feasible to calculate the actual requirements of these service points and adjust the capacity of institutions and service enterprises to align with demographic shifts and trends. This is of great significance as the integration of various service facilities into a coherent network can significantly contribute to urban development and streamline the urbanization process.

Moreover, the concept of this research carries particular weight in the context of postwar reconstruction in Ukraine. In the aftermath of the conflict, cities grappling with the daunting task of rebuilding not only their physical infrastructure but also their social and public service networks can apply this concept. By understanding the dynamics of how different service facilities interact and attract residents within specific zones, urban planners and policymakers can strategically allocate resources during the reconstruction phase. This can enhance the efficiency of service delivery,

optimize the placement of essential institutions, and contribute to the overall revitalization of urban areas. In all, the careful consideration of service facility networks becomes an integral component of the broader efforts aimed at fostering sustainable and resilient postwar cities.

4   Conclusions

The extensive research conducted on the social planning system, its structure, and the factors influencing it, coupled with the development of an information model, has highlighted important insights into the urban development and postwar reconstruction of Ukraine, with a particular focus on the city of Uzhhorod. The information model delineates the intricate web of relationships within the social planning system, comprising three fundamental elements: population, territory, and institutions. These elements interact in a dialectical manner, embodying the dynamic nature of urban systems. Through rigorous analysis, it has been revealed that various historical periods have significantly shaped Uzhhorod's structural development, which, in turn, has had a profound impact on its social composition. One prominent observation is the persistence of population density within the city, despite the existence of numerous residential areas. This uneven distribution of inhabitants across the urban landscape, coupled with the partial or complete absence of consumer service institutions in certain areas, underscores the need for a comprehensive approach to optimize the social planning system.

   In light of these findings, a range of urban development methods has been identified to address the optimization challenges inherent in medium-sized cities. The social organization and planning framework, seen as a materially spatial system comprising both anthropogenic and natural elements (i.e., territory and institutions), serves as the crucible in which functional processes manifest in the urban planning environment. The versatility of this concept allows it to accommodate the characteristics of diverse facility categories. Accordingly, the optimization challenge of public services within the city has transitioned into (somewhat of) a mathematical model, that is, by establishing fundamental design criteria and patterns, we can attain the most favorable outcomes. This model, while focused on Uzhhorod, serves as a blueprint for the broader context of postwar reconstruction in Ukraine. It facilitates the optimization of the city's social planning organization by ensuring equitable service coverage, optimal utilization of facility resources, and the minimization of average service radii. In sum, this chapter not only contributes methodological principles but also provides valuable recommendations for enhancing the social and planning structure of medium-sized cities. As Ukraine embarks on its postwar reconstruction process, this research lays a solid foundation for fostering inclusive and resilient urban communities, harmonizing the urban landscape with the unique identities and needs of its inhabitants. Ultimately, it stresses a path toward sustainable and prosperous medium-sized cities that will play a vital role in Ukraine's post-conflict recovery.

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