

Fostering Local Urban Centers in relation to district train stations as part of the transition from a post-industrial to a sustainable city: a case study of Katowice

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Abstract. The research problem investigates the application of the concept of local urban centers (LUCs) in transforming post-industrial cities into sustainable cities. The subject of the study is Katowice, undergoing a transition towards modern services, while also grappling with an industrial legacy that results in an imbalance of development processes. The idea of LUCs, developed in relation to existing and new district train stations, based on the concept of the 15-minute city, was proposed by the authors within the Katowice development strategy and further tested within the Urban&Business Lab workshops. The research showed, that although in a model approach, service concentration points and public transport nodes should be closely linked, in the existing conditions of Katowice, they almost always deviate from the ideal model. Nevertheless, in each of the cases analyzed, elements of functions and spaces can be observed that have the potential which have the potential to foster LUCs.

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1. Introduction

One of the first definitions of sustainable development, originating from the Brundtland Report, describes it as development that meets the needs of present generations without compromising the ability of future generations to meet their own needs (UN, 1987). A key feature of this approach is the consideration of development over a long period of time, with an elevated significance of future generations. In contemporary times, socio-environmental aspects are beginning to dominate the discourse on sustainable development. For instance, the Worldwatch Institute report (2016) emphasizes the growing importance of cities in the context of climate change.

In the context of climate change, cities are not the best examples of sustainable development (Grender, 2014). Concentrated on just 3% of the Earth's surface, they are responsible for consuming 80% of energy and 75% of CO₂ emissions (UN, 2020). To meet the goals of reducing emissions by 1.5°C by 2030, cities would need to cut their transport emissions by 30% (C40 Cities, 2018).

Sustainable Development Goals (SDG) proposed by the UN (2016) are recommendations directed at policymakers to take rational actions to bring cities closer to sustainable development. The SDG essentially defines the contemporary concept of a sustainable city (de Jong et al., 2015), focusing mainly on the sustainable use of resources. The green city concept offers a slightly different emphasis on sustainable development, pointing to the great importance of environmentally healthy and resilient cities (OECD, 2018), emphasizing a more rigorous accounting between the relationships of human settlements and blue & green infrastructure (Garcia-Lamarca et al., 2021). In the green city approach, the natural environment (including blue & green infrastructure) becomes a priority in the process of creating infrastructure for the flow of people, goods.

How do post-industrial cities cope in the context of SDGs, and the green and sustainable city concepts? The emergence of this category of cities in Western Europe and the USA in the second half of the 20th century is associated with the shift of their economies from industry to services. In a conceptual sense, post-industrial cities are increasingly based on an economy driven by knowledge and information. New activities emerge, such as software programming, IT services, business process outsourcing, creative industries, shopping malls (Kendall, 2010).

However, the conceptual image of the post-industrial city in real life turns out to be more complex. It does not capture the characteristics

of a city during the transition "from industry to services". The transition period is associated not only with a smooth shift to services but often with negative features, including (Lever, 1987): the release of large amounts of low-quality human capital resources, changes in employment locations in space; polarization of residents in terms of income, access to transport infrastructure, living conditions; downgrading of a city, deurbanization, release of post-industrial lands.

2. Local Urban Centers as an operationalization of the sustainable city in the context of a compact 15-minute city

Turning to operational solutions as a response to the postulates of sustainable urban development, it is assumed that the appropriate structure, i.e., consistent with sustainable development, is a compact, polycentric city; known also as "city of short distances", "close-knit city", and recently as a "15-minute city", introduced by Carlos Moreno in 2016 in a popular article in *La Tribune*, in regard to Paris, and further conceptualized in the following years (Beim, 2021; Moreno et al., 2021). Moreno (2021) posits that the quality of urban life is inversely proportional to the time required for commuting, particularly by car. Enhancing quality of life, conversely, is the ability to fulfill six basic social functions within the immediate neighborhood. These functions include (1) living, (2) working, (3) commerce, (4) healthcare, (5) education, and (6) leisure.

Proximity is considered in two dimensions: temporal and spatial. Time is crucial for urban design since urban spaces can contain proximate facilities that are nonetheless hard to access (e.g., additional walking distance due to pedestrian paths, time lost at traffic signals). This concept aligns with the core philosophy of *chronourbanism* - urban planning based on time management. Proximity in the 15-minute city concept enables residents to move between residential areas, workplaces, commercial zones, educational institutions, healthcare centers, and other fundamental institutions within a reduced timeframe. It is important to note that the 15-minute city concept does not detail its terms and, as a general idea, requires concrete adaptation to local conditions (Moreno et al., 2021). The concept of the 15-minute city has been extensively researched and applied to different urban contexts worldwide (at the moment

of the publication, Google Scholar returns 3600 articles on the subject).

The compact, mixed-use urban structure reduces the need for travel, and one can mainly move around on foot or by bicycle (Gehl, 2001). Such structure also rationalizes the development of public transport, with the formation of local centres integrated with public transport stations and transfer nodes, as expressed in the idea of Transit Oriented Development (Loo & Verle, 2017). In a compact city, the concentration of buildings and functions should simultaneously allow for the preservation and creation of green spaces, in the sense of blue & green infrastructure (Bradecki et al., 2022). A compact city means higher building intensity and, consequently, less resource consumption, i.e., less land use and lower commuting costs (Bibri et al., 2020). In the social dimension, it favors the stimulation of human contacts (Haarstad et al., 2023).

Local urban centres (LUCs), perceived as the operationalization of the 15-minute city, are key components of the network of central places and carriers of certain non-transferable functions at other levels of the urban hierarchy. They play a crucial role in the life of local communities, offering access to everyday services and contributing to improving the quality of life and creating local social ties (Damurski, 2020). The functional aspect of LUC includes trade, services, education, culture, health, recreation, entrepreneurship. Functions that build the identity of the district, such as a local museum, cultural centre, social activity centre, can be particularly important, as they may attract visitors (Krehl & Siedentop, 2019). The public space around LUC is of key importance, and therefore should be shaped to stimulate activity and interaction. The key importance of linking LUC with public transport is also pointed out (Stangel et al., 2017).

The outlined conceptual image of a sustainable, green, and compact city, including the idea of LUC, raises a number of implementation problems, especially in post-industrial cities that are in the stage of transition "from industry to services". Negative features accompanying the transition of post-industrial cities are associated with a breach not only of the socio-economic structure but also of the spatial one. The directions and intensity of residents' commuting have changed, some districts have lost their previous central functions, infrastructure previously subordinated to industry has proved ineffective. Thus, a city in the era of transition "from production to services" is a place particularly unbalanced socially, economically, and spatially. Taking the above into account, the research problem of the article is defined as follows: how to use the

idea of LUC in the transition of a post-industrial city towards a sustainable one?

An interesting example of a dynamically changing post-industrial city in the last two decades is Katowice, the capital of the 4.6 million Silesian Voivodeship and the over 2 million Upper Silesian-Zagłębie Metropolis (GZM). The city is making significant progress in becoming an attractive place to work and live for a new generation working in a modern and creative economy. At the same time, it is struggling with changes in the spatial structure and its imbalance, excessive congestion, and the loss of status of districts with a post-industrial legacy. One of the key elements in the City Development Strategy 2030 is fostering LUCs.

3. Research materials and methods

The research problem in relation to Katowice was executed based on the following research tasks:

- Task 1 - characterization of Katowice as a post-industrial city
- Task 2 - defining strategic development goals for Katowice emphasizing the creation of a sustainable city within the updated Katowice City Development Strategy 2030 (SRMK2030)
- Task 3 - translating the strategic development goals for Katowice into the city's space – formulating a model of functional-spatial structure
- Task 4 - operationalization of strategic and spatial arrangements in terms of creating LUCs as a proposal to balance the spatial, socio-economic, and environmental structure of Katowice

In Task 1, desk research was conducted based on diagnostic reports of the City of Katowice (IETU, 2021; IETU, 2021a). The authors also participated in preparing a report identifying the main developmental challenges of Katowice (Katowice City Council, 2022); they conducted interviews and meetings with the heads of various departments of the City of Katowice and city authorities.

In Tasks 2 and 3, the authors employed a series of social research techniques including: (I) meetings with the Steering Committee, Task Team, and the Just Transformation Team; (II) a questionnaire research of Katowice residents during May-June 2022 (n=242 respondents) (Katowice City Council, 2022a); (III) focus group interviews (FGI) in June 2022 with residents in 5 groups of district teams (n=93 people), FGIs with stakeholder groups in November 2022, including heads of the City Hall departments of Katowice, the Just Transformation Team, the Council for Public Benefit, the Council for People

with Disabilities, the Senior Council; the Youth Council, and entrepreneurs. The updated SRMK2030 was prepared in accordance with strategic planning and urban planning methodology.

The meetings with (I) the Steering Committee, the Task Force and the Just Transition Team in the methodological sense were semi-structured interviews, and they were conducted throughout the whole planning process of the Katowice Development Strategy (i.e. from February 2022 to June 2023). These teams consisted of decision-makers, i.e. the mayor and vice-mayors of the city (the Steering Committee), operational managers of the Katowice City Hall (the Task Force), vice-president, selected operational managers and selected councilors (the Just Transition Team). The questions concerned the verification of: key development challenges of Katowice, values creating a new vision of the city's development, priorities, strategic goals and development projects, including Local Urban Centers.

The aim of the (II) questionnaire research (conducted in the form computer assist web interview) was to collect the opinions of Katowice's residents on: the city's strengths, expected changes, the importance of selected areas of Katowice's development, and expectations including Local Urban Centers. Closed questions were used with a wide catalog of answers and the possibility of entering your own answers in the category 'other, please specify what?' The selection of the group was purposive sampling, where the main criterion was the place of residence in Katowice. In terms of sample allocation, attention was paid to the criterion of the proportion of respondents between the Katowice's districts. The questionnaire research was conducted as part of public consultations of the new Katowice Development Strategy, hence it was voluntary. Questionnaires were collected from 242 residents, which cannot be considered representative in strictly quantitative terms. However, the results obtained represent the opinions of those residents who are most actively interested in the development of Katowice.

To obtain a higher level of representativeness, (III) 5 FGIs were also carried out in five locations, which were addressed to all districts of Katowice (from June to July 2022). The selection of FGI participants was purposive sampling in the context of the spatial criterion, i.e. residents living in a given set of districts participated in particular one of five FGI, and in the context of representing key entities in a given set of districts (i.e. non-governmental organizations, schools, enterprises, public institutions, police). FGIs, like the questionnaire research, were conducted in the form of public consultations and were voluntary. FGIs gathered 93 participants. The thematic scope of

the FGIs questions concerned proposals for activities for Katowice and for a given district (in community, economy, environment and infrastructure, space, governance contexts), including Local Urban Centers. FGIs was also conducted in a similar way with other stakeholder groups (November 2022), including heads of the Katowice City Hall departments, the Just Transition Team, the Council for Public Benefit, the Council for People with Disabilities, the Senior Council, the Youth Council, and entrepreneurs.

Task 4 - the research on the potential of fostering the LUC in Katowice was conducted within the framework of mentoring an interdisciplinary Urban & Business Lab (UBL). It is a project in which students from the University of Economics and the Faculty of Architecture at the Silesian University of Technology, in cooperation with the Katowice City Hall, address current issues relevant to the development of Katowice. The research methods applied in UBL included: (I) study visits and field analyses at each location of planned train stops, including photographic documentation, a "place game" survey (PPS, 2016), and unstructured interviews with people met in the field. The Place Game is a tool for evaluating public spaces and their surroundings, and was adapted to examine the proximities of the train stations. Its 1st section includes a list of 16 criteria for subjective evaluation of the place, grouped in 4 sections: comfort & image, access & linkages, uses & activities, and sociability. The second section includes five questions to identify local opportunities:

1. What do you like best about this place?
2. List things that you would do to improve this place that could be done right away and that wouldn't cost a lot
3. What changes would you make in the long term that would have the biggest impact?
4. Ask someone who is in the "place" what they like about it and what they would do to improve it.
5. What local partnerships or local talent can you identify that could help implement some of your proposed improvements?

The survey was meant as a pilot study for assessing the place potential and was not meant for statistical significance. It was conducted within the students groups ($n=6 \times 4=24$ people) and the student teams were advised to speak with a minimum of 5 different people met on each site ($n=6 \times 5=30$ people).

Further research methods in Task 4 included: (II) strategic analysis of areas where train stops are planned along with identification of projects supporting LUC, (III) map analyses of the surroundings of train stops in relation to potential

elements of the LUC, within a notional radius of 500 meters; including an analysis of the availability of local services using the online GIS application "15-minute city-spatial accessibility" (2024), provided by the GZM Metropolis (<https://infogzm.metropoliagzm.pl/mapy/miasto-15-minutowe>); (IV) the research by design method, which in this case can be defined as "research through designing" (Solarek et al., 2022). This approach involved searching for the optimal integration of new train stations with their surroundings; (V) two joint FGIs with students from both universities (n=43 students). The data for the maps were gathered through Google maps and supplemented with information from site visits, and the final diagrams were elaborated in CAD and graphical software, according to students teams individual preferences.

4. Research results

4.1. Katowice: a post-industrial city in transformation

Katowice was granted city rights in 1865 and since then has entered a dynamic phase of growth as an industrial centre, which lasted until the late 1980s. The 1990s saw the city experience a decline in traditional industries, weakening of its socio-economic status, and an outflow of residents (Drobniak, 2012). From that point on, for two decades, Katowice has had a negative image as a city associated with the collapse of heavy industry, degraded environmental conditions, and dilapidated buildings and public spaces.

Transformational changes towards a modern post-industrial city, initiated at the beginning of the second decade of the 21st century, brought about a positive change in the image of Katowice. Projects such as the renewal of public spaces in the centre, the Culture Zone, new office buildings, renovations of the road system and tram network, participation in the UNESCO Creative Cities Network, and hosting two global events, i.e. COP24 and the World Urban Forum, are achievements that the City can boast about (Drobniak, 2023).

Positive changes are mainly visible in the downtown area and the southern districts. However, the adverse effects of deindustrialization are still apparent. Those districts that were strongly associated with heavy industry in the past are struggling with socio-economic and spatial problems. In the northern and eastern parts of

Katowice, there are several post-industrial sites that require redevelopment. As the central city of the GZM, Katowice serves as the central business district for the largest urban agglomeration in Poland, which, despite obvious socio-economic benefits, is associated with excessive strain on the road infrastructure. It is estimated that about 120,000 vehicles enter the city each day (Jedlecki, 2019), generating inefficiency in road infrastructure (Katowice City Council, 2016).

Katowice is facing the need to create a more sustainable urban centre that can meet the challenges arising from the Paris Agreement (UN, 2015) and the European Green Deal (UE, 2019). This means that the transition must continue in a more balanced way because, as residents note, the economic function of Katowice is beginning to unfavorably dominate over local functions (Strategy, 2023).

Conclusions drawn from the transition of Katowice up to date, as well as legislative changes related to the need to prepare a municipal development strategy (Act, 1990), prompted the Katowice City to decide to update the development strategy. A significant innovation in the work on the updated strategy was the use of an integrated approach in formulating the strategy's records. (Fig. 1).

4.2. Strategic development of Katowice emphasizing the pursuit of creating a sustainable city

In Polish local governments, the development strategy until 2022 was an optional document, yet often created due to its utility in justifying and focusing actions. In the era of popularized integrated planning (Markowski, 2014; Wojnicka-Sycz, 2018) and in connection with the amendment of the act on the principles of development policy (Act, 2023), the municipal development strategy has become a mandatory document. It indicates, in the context of integrated planning, the necessity of parallel preparation of the strategic part (strategic goals and directions of actions) and the urban part (model of the functional-spatial structure).

Limiting the detailed analysis of the records of updated SRMK2030 to content related to the transition of the post-industrial city towards sustainable development, it is important to emphasize the following statements of this document:

- Strategic field PS2. Metropolis - emphasizing the necessity of balancing metropolitanity and locality,

including the integration of metropolitan activities with the distinctive features of districts;

- Strategic field PS4. Climate and urban ecosystem
- creating a green city, including active mitigation and adaptation to climate change, care for the diversity of ecosystem services, and strengthening the ecological awareness of residents;
- Strategic field PS5. Space and infrastructure
- basing spatial development on the concept of a compact city by relating the idea of a 15-minute city to LUC, including emphasizing the creation of multifunctional building structures integrated with public space and public transport.

4.3. Model of the functional-spatial structure of Katowice

The model of the functional-spatial structure contained in *SRMK2030* reflects the records of strategic goals in the spatial dimension. It graphically defines strategic directions of action, functional connections and developmental needs. The desired, target model of the functional-spatial structure defined in *SRMK2030* is a compact city (Strategy, 2030), which is a spatial expression of shaping the city according to the principles of sustainable development. The model assumes that the structure of Katowice's settlement network should be balanced and stimulate the integration of districts as neighborhood areas shaped around LUCs integrated with public transport nodes.

The records of *SRMK2030* emphasize that transport systems should be developed according to the principles of sustainable mobility. Priority is given to the development of pedestrian, bicycle and public transport (rail and tram). The promotion of such communication is to be served by solutions improving the comfort and safety, functionality and connections of pedestrian paths and public spaces. Such solutions should be popularized as part of transformations of existing structures as well as the creation of new ones, including LUCs.

The directions of changes in the structure of land use resulting from the assumed functional-spatial model and from the goals of *SRMK2030* include:

- Implementing the idea of a compact city expressed in dense, multifunctional buildings providing close access to public space and sustainable transport;
- Creating multifunctional LUCs integrated with public transport hubs and green areas at existing and new metropolitan railway stops;

A graphical presentation of the functional-spatial model of Katowice emphasizing the significance of LUCs is shown in Figure 1.

Figure 2 presents the various types of LUCs diagnosed in Katowice, distinguished due to different relationships of service concentration in relation to existing or planned railway station: (1, 2) the station is located in the geometric centre of the neighborhood unit and at the place of service concentration – a model example of Transit Oriented Development; (3) the station and the place of service concentration are located on the edge of the neighborhood unit; (4) the place of service concentration is located in the geometric centre of the neighborhood unit and the station on its edge; (5) two stations on the edge are linked by public spaces with the place of service concentration; (6) the neighborhood unit has a shaped place of service concentration in the absence of a public transport station; (7) there is no neighborhood unit around the station; (8) the station is located at the junction of two separate neighborhood units.

4.4. LUCs towards a sustainable spatial, socio-economic and environmental urban structure

Further work related to the operationalization of the *SRMK2030* provisions in terms of implementing LUCs, conducted within the framework of UBL, covered six locations of new railway stops. The Kostuchna railway stop is located in the geometric centre of the suburban district of Kostuchna, at the railway crossing with the main communication axis of the district. Directly at the station, there are bus stops and basic services: grocery stores, a bakery, a flower shop, dining places, and a clinic. Within a radius of about 250 meters, there are also a primary school, nursery, kindergarten, and a district cultural centre, housing a local theatre, as shown in Figure 3. Approximately 300 meters away is the beginning of a post-mining spoil tip slope, reclaimed as a green area. The LUC area could be expanded at the expense of a small part of allotment gardens, shaping a transfer centre with access and parking lots.

The Ochojec railway stop is located within close distance to local services but far from the centre of the Ochojec-Piotrowice district. Directly at the station, on the southeast side, a new residential estate is planned (Fig. 4). The layout of open spaces in the estate and local services in the frontages may be crucial for the functioning of this LUC. On

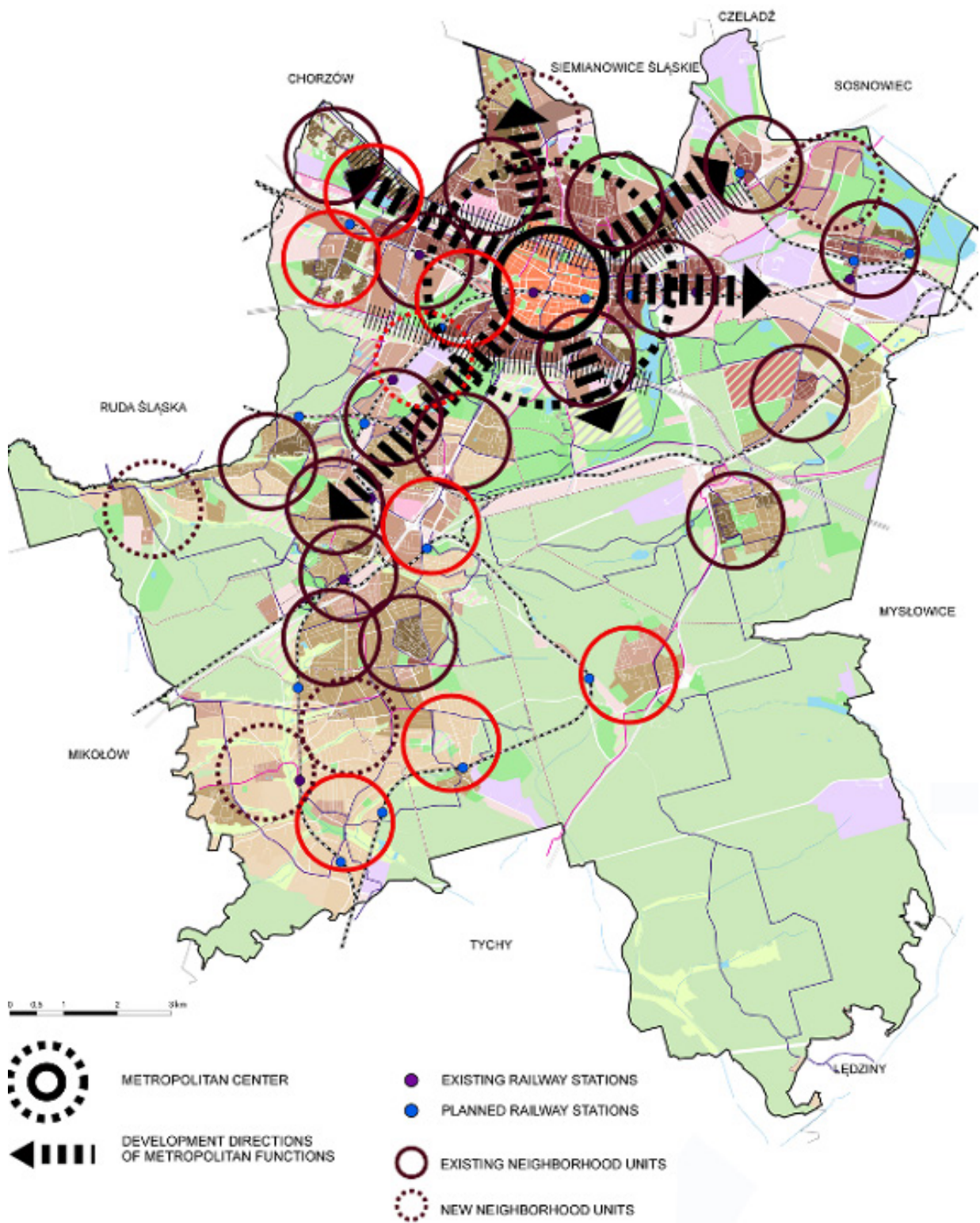


Fig. 1. Diagram of the functional-spatial structure model: schematic of the functional structure, with the designation of LUCs (neighborhood units)

Source: elaboration by Michał Stangel, Klaudia Plac

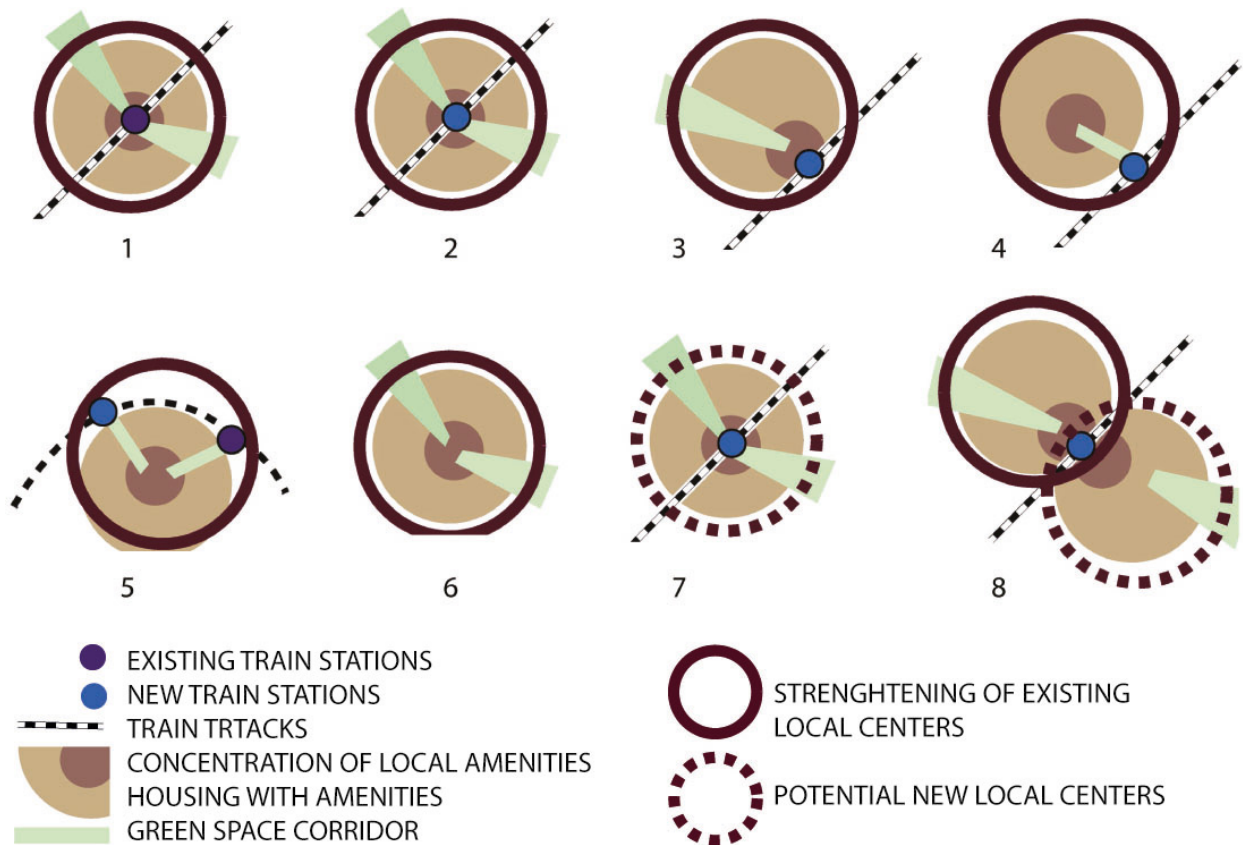


Fig. 2. Diagram of the functional-spatial structure model: schematic of the functional structure, with the designation of LUCs (neighborhood units)
 Source: Authors elaboration

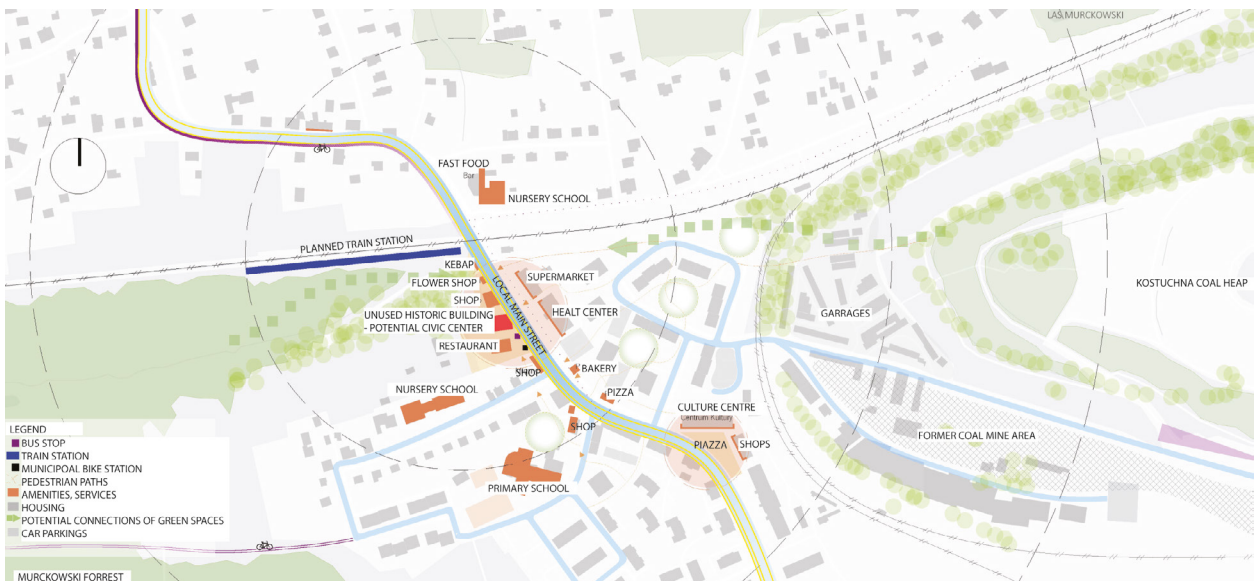


Fig. 3. Existing and potential amenities in the LUC near Kostuchna station
 Source: Elaboration by students guided by the author: Daria Dziuk, Aleksandra Masłyka

the north side, towards the shopping centre (CH Leclerc), there is a land reserve that can be used for transfer infrastructure and local services.

The Podlesie Saska railway stop is located on the edge of the Podlesie district. The area of local service concentration is only about 700 meters west of the station. Due to its peripheral location, the railway stop's potential for being a central hub is clearly lower, but the appropriate shaping of the access route could improve the accessibility of this place. It would be advisable to supplement the infrastructure for passengers, for example, with parking for bicycles and cars, a bicycle station, a beverage vending machine. On the eastern side of the station, there is a glade in the forest area, which could be used to create a centre for ecological education (cf. Ecological Education Centre in Łagiewnicki Forest in Łódź). The locations of possible new functions of the LUC in relation the railway station are shown on Figure 5.

The Murcki railway stop is located on the edge of the Murcki district (formerly associated with the closed Murcki mine) in a forest area. The area of local service concentration is about 500 meters east of the station. The potential LUC area includes: a path through the forest area about 200 meters long; a section of Samsonowicza Street to Kasprowicza Square (the centre of the district). In such a defined

LUC, it is necessary to improve the quality of public space (tree planting, small architecture, service premises on the ground floors). An important element is to improve the safety of the existing pedestrian route (through the forest area) by creating a surface for pedestrian and bicycle traffic, lighting, surveillance, and new local amenities, as a cafe and ecological education pavilion, as shown on Figure 6.

The location of the Osiedle Witosa railway stop (on the site of former Kleofas mine) has significant potential for becoming a central hub for two districts, i.e., Osiedle Witosa and Załęże (by connecting them by the station from the south and north, as shown in Figure 7). In creating the LUC, on the southern side, it is necessary to create forecourts of the railway station including a station square with services, complementing the existing commercial function with additional features (service passage, dining, small services). The stop should be conveniently connected by foot with the residential buildings planned on the site of the closed Kleofas mine.

The location of the Bugla railway stop on the territory belonging to the Police garrison does not allow for the shaping of central elements. Access to the stop behind the fence of the Police territory will be unfriendly. There is no land for additional functions to complement the station due to the

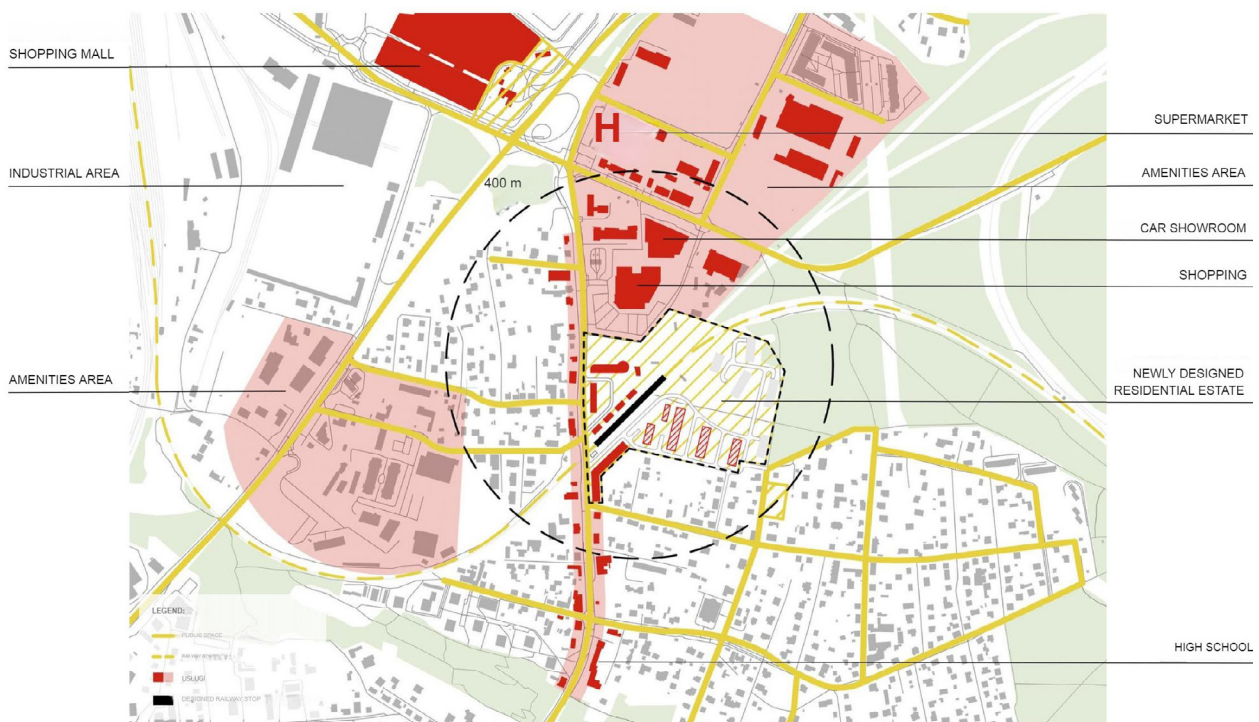


Fig. 4. Existing and potential amenities in the LUC near Ochojec station

Source: Elaboration by students guided by the author: Weronika Pudełko, Magdalena Szczotka



Fig. 5. Existing and potential amenities in the LUC near the Podlesie - Saska station
 Source: Elaboration by students guided by the author: Agnieszka Ścigała, Karolina Supron

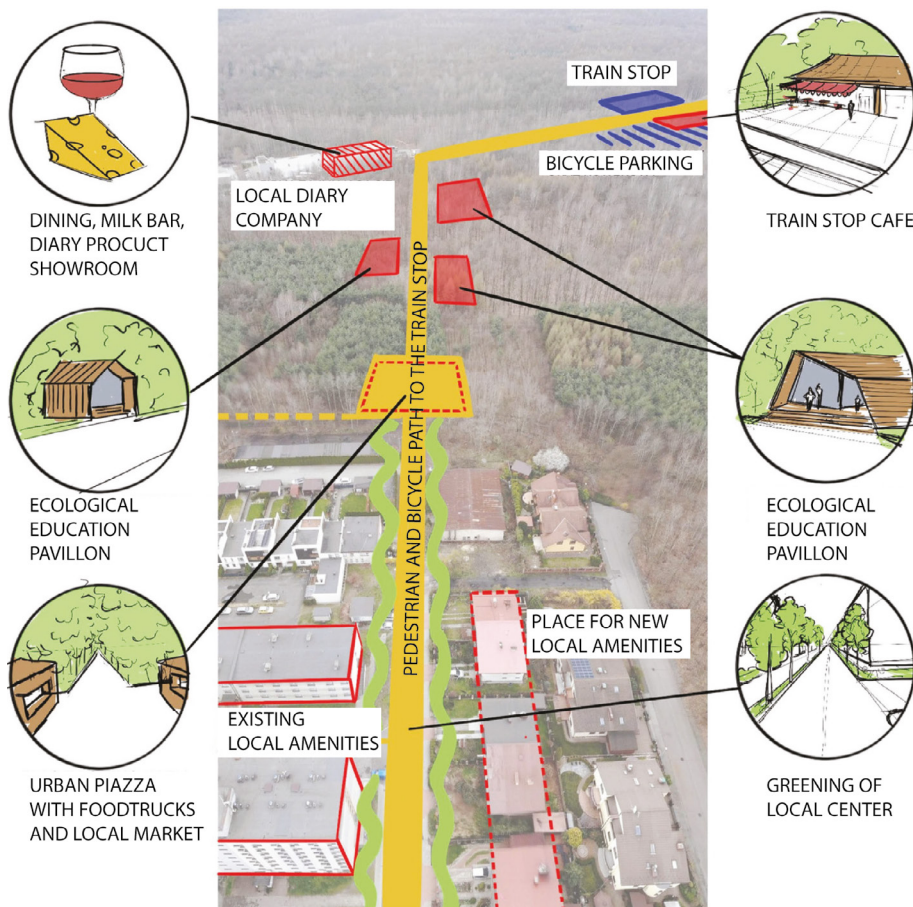


Fig. 6. Existing and potential amenities in the LUC near the Murcki station
 Source: Elaboration by students guided by the author: Julia Banaś, Zofia Witaszczyk

direct vicinity of the A4 motor way infrastructure. Better utilization of the station's potential as a central hub would be facilitated by moving the station south of the A4 motorway, to the area of the currently phased-out Wujek mine, and linking it with the future revitalization of this area. Changing the location would enable better connections of the station with neighboring areas, the road system, etc. Such a configured LUC would serve as a link with new functions created on the lands of the former Wujek mine (Fig. 8).

5. Discussion and conclusions

This study introduces novel insights into the concretization and operationalization of fostering LUCs around planned railway stops, particularly within the unique urban fabric of Katowice, a post-industrial city. The authors delineate the innovative approach adopted from the inception phase during the update of Katowice's Development Strategy 2030, through to the integration of LUC concepts into the city's functional-spatial model, and the subsequent pilot assessment of the centrality potential of selected railway stops as part of an interdisciplinary project within the framework of an interdisciplinary project conducted within UBL.

Comparatively, existing literature on LUC development primarily focuses on theoretical models or isolated case studies without the depth of integration into urban planning strategies that our work offers. Our findings extend beyond the recognized benefits of LUCs by demonstrating their practical application and the tangible outcomes of such integration in a city's developmental blueprint.

We have identified two principal scenarios in our study. The first scenario showcases locations where the existing infrastructure and services surrounding the railway stops naturally lend themselves to the creation of LUCs, emphasizing the importance of enhancing spatial qualities, such as greenery and pedestrian-friendly environments. The second scenario illustrates areas where spatial and service-oriented discrepancies exist, suggesting a novel approach to creating a sequence of public spaces that evolve into a "linear LUC", supplemented with urban amenities.

The similarities between our findings and existing knowledge reinforce the value of LUCs in enhancing urban liveability. However, our research also highlights the critical differences in application and outcomes, demonstrating the importance of context-sensitive planning and the potential for LUCs to adapt to various urban settings.

From our analysis, it is clear that the successful development of LUCs requires a multifaceted



Fig. 7. Existing and potential amenities in the LUC near the Osiedle Witosa station
Source: Elaboration by students guided by the author: Ewelina Jeziorska, Paulina Ćwiczek

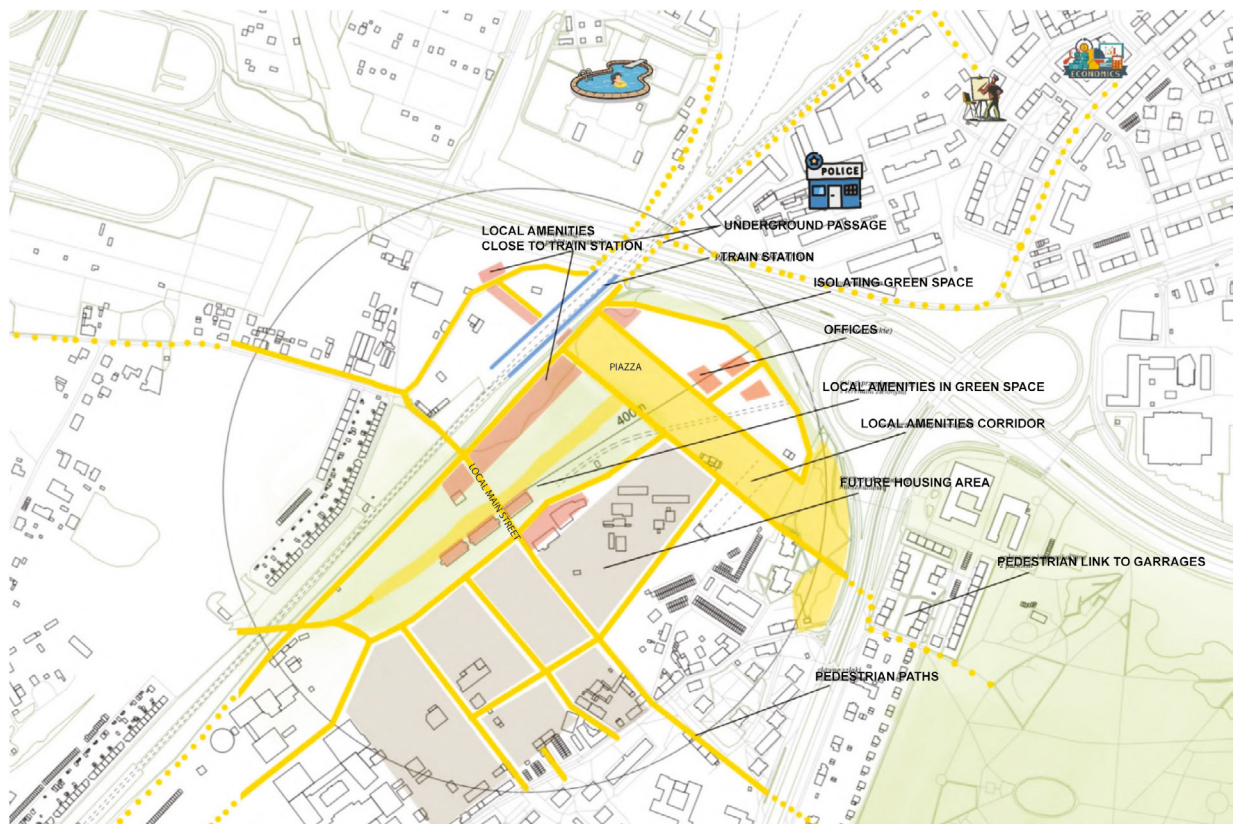


Fig. 8. Existing and potential amenities in the LUC near the Bugla station

Source: Elaboration by students guided by the author: Agata Kocur, Sara Nocula, Izabela Bogańska

approach, combining strategic planning, stakeholder collaboration, and a deep understanding of local contexts. This approach not only validates the hypothesis that LUCs can significantly contribute to urban improvement but also offers a blueprint for their implementation in similar urban contexts.

Moving forward, our research agenda includes the exploration of LUCs' long-term impacts on urban liveability and sustainability, further refinement of the integration process in urban planning, and the replication of our methodology in other post-industrial cities. The results confirm our hypothesis, showcasing the potential of strategically located LUCs to transform urban spaces into more liveable, sustainable, and integrated communities.

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