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SMART DISTRICTS: NEW PHENOMENON IN SUSTAINABLE URBAN DEVELOPMENT
Case Study of Špitálka in Brno, Czech Republic

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Abstract
The aim of this paper is to explore how underused brownfield sites could be transformed by employing smart city elements into positive energy districts. This paper introduces the analysis of good practices in construction of smart districts, focusing on the construction possibilities of smart district Špitálka in the Czech Republic. Methodologically, the paper is based on qualitative semi-structured interviews with experts on urban policies and desk research method of available information. This paper presents both the conceptualization of smart city and theoretical approaches to the smart districts. Then an international research of smart districts in French Bordeaux and Austrian Vienna is presented. The author pursues to make recommendations for the Czech smart district based on the best practices of selected case studies for the Brno Špitálka project. Findings of this research point out the importance of taking the inspiration of best practices for post-socialistic cities from Western European countries in the process of redevelopment brownfield areas into the so-called smart districts. One of the possible ways is joining the lighthouse projects of European Union.

Key words
Sustainable Urban Development, Smart City, Smart District, energy neutral, Czech Republic.

INTRODUCTION

Modern cities are currently confronted with many challenges related to mobility, waste management or with access to resources (Simonofski et al., 2019). Europe faces an increasing urbanization rate of around 80%; people struggle with environmental pollution and high-energy consumption. It is projected that urbanization will continue in the coming years and that the demand for energy, mobility, water, and other services in cities will be higher. Cities constitute the complex sociotechnical systems and play a very important role in delivering a variety of services to more than half the world's population (Razaghi and Finger, 2018). Since the 1990s the concept of sustainability has risen to prominence, which is often linked to urban regeneration (Kecskés and Kozma, 2020). New information and communication

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technologies are a way for cities to increase their competitiveness, including using renewable energy sources. The smart and intelligent city is aware of all these challenges and implements the necessary policies, such as brownfield revitalization into the smart districts as a new way to deal with current urban challenges. Attention is paid to the quality of life of citizens and people prefer life in cities to the countryside. Due to the limited space of cities and growing urbanization rate, cities deal with the question of how to satisfy the growing demands and needs of citizens. One of the possible solutions is the revitalization of unused urban spaces. These are the so-called brownfields, which means an area, building or space that is unused and may be contaminated. According to The Business and Investment Development Agency CzechInvest (2019), the brownfields are remains of industrial, agricultural, residential, military or other activities. According to the definition of brownfield by Alker et al. (2000) – the brownfield site as any land or premises, which has previously been used or developed, and it is not currently fully in use. Urban development is not only a process of horizontal and vertical growth direction but is above all a natural permanent regeneration of the settlement structure in its functional and material essence (Sovičová, 2012). An assumption for successful brownfield revitalization is the socio-economic factor and the so-called green development. Projects including sustainable development elements represent the higher value for brownfield revitalization (Green, 2018). The process of revitalisation is defined by Matlovič and Sedláková (2007) as "*continuous adaptation, reconstruction and expansion (horizontal and vertical addition) of already existing objects, or the substitution of old buildings by the new*."

This paper deals with a new phenomenon in sustainable urban development, the so-called smart districts. Smart district's construction is a new way of revitalization of unused urban areas at the place of former brownfield sites. Smart districts are part of cities, the complex systems that actively manage its energy consumption and implement the elements of smart city concept. Smart district integrates modern technologies to create a smart grid (Good, Ceseña and Mancarella, 2017). In the Czech Republic, for example, it is the Brno Špitálka project, which is the subject of broad discussions. Špitálka project is being inspired by the new smart district of Seestadt Aspern in Vienna, which grew up at the former airport. Another smart district project is built in French Bordeaux, which also constitutes a good example for the Špitálka project. This paper presents the theoretical approach in defining the concept of smart cities, smart districts and brownfield revitalization.

The aim of this paper is to explore how underused brownfield sites could be transformed by employing smart city elements into positive energy districts. This paper introduces the analysis of good practices in construction of smart districts, focusing on the construction possibilities of smart district Špitálka in the Czech Republic. Methodologically, the paper is based on qualitative semi-structured

interviews with urban experts and desk research method of available information. Analysis of the practice of smart districts construction in selected foreign cities, namely Vienna and Bordeaux, contributes to fulfil the objective of presented paper. Findings from the foreign research are applied to establish recommendations and show the possibilities of financing for the smart district project called Špitálka, which is planned in the city of Brno in the Czech Republic. The Špitálka project has the ambition to transform an unused part of the heating plant Teplárny Brno complex into a smart district. This project is unique in the environment of the Czech Republic, as it is one of the first coherent projects with more characteristics of smart city. The project comprises of the construction of new flats, the creation of services and the creation of new jobs, all using smart technologies leading to energy-efficient and environmentally friendly buildings.

THEORETICAL FRAMEWORK

Both the issues of brownfield revitalization and the concept of smart cities are considered as a subject of scientific research in the long-term period. However, much attention has not been paid to the combination of these two phenomena, or more precisely the brownfield revitalization in smart cities. The issue of brownfields regeneration is often associated with the phenomenon of sustainable development (Bartke and Schwarze, 2015), as successful regeneration should prevent the re-emergence of future brownfields (Vojvodíková et al., 2011). Brownfield redevelopment projects with a sustainable development element represent a higher value of brownfield redevelopment. According to Atkinson et al. (2014), revitalizing a brownfield into green space brings multiple benefits as an opportunity to return land to citizens. However, there are some limitations associated with the conversion of underutilized spaces into green spaces, as the purpose of such a project is not to generate profits compared to the construction of residential blocks (De Sousa, 2003). However, added sustainability elements do not necessarily imply additional financial costs (Schädler et al., 2011). The concept of smart city and green in-frastructure is discussed by Artmann et al. (2019), according to whom these two concepts reinforce each other when interacting.

Glasmeier and Christopherson (2015) claim that renovation and restoration of already existing areas is typical for smart cities rather than building wholly new urban environments.

The smart city concept has gained popularity in the last decade, however the definition of this phenomenon still remains inconsistent (Yigitcanlar et al., 2018c). Prahajar and Han (2019) note the interchangeability of the concept of smart with other urban concepts such as the digital city (Yovanof and Hazapis, 2009), the technology city (Foord, 2013), the city with smart grids (Batty, 2012), the information city (Schmitt, 2015), a knowledge-based city (Yigitcanlar et al., 2008) or a creative and sustainable city (Florida, 2005). The phenomenon of smart city was

at first used in the 1990s to describe the use of information and communication technologies to improve infrastructure and modernize networks (Rana et al., 2018). As Hollands (2008) points out, the path to a successful smart city does not lead through a blind faith in technology, but the involvement of citizens and human capital is key. Daekin and Reid (2018) examine the interdisciplinary understanding of smart cities and an overview of the Triple Helix model on Internet development in digital infrastructure, data management systems, renewable energies and cloud computing of a regional innovation in the Internet of Things. Giffinger et al. (2007:11) define the concept as follows "*a Smart City is a city well performing in a forward-looking way in these six characteristics (see table no.1), built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens*." Based on Giffinger's definition, Caragliu et al. (2011) "*believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance*." Yigitcanlar et al. (2018a, 2018b) emphasize the importance of sustainability and knowledge-based development in relation with the smart city concept: "*the smart city is an urban locality functioning as a healthy system of systems with sustainable and knowledge-based development activities to generate desired outcomes for all humans and non-humans*." Subsequently Yigitcanlar et al. (2019) state that cities cannot be smart without being previously sustainable. Smart city is nowadays seemed as a balance between information and communication technologies and human beings with the purpose to improve the quality of life (Mattoni et al., 2015).

The majority of studies focus on the positive aspects that smart cities can contribute. However, there is a lack of authors who point out the negative feature of technology and the failure of the smart city projects. Critics argue that economic growth as one of the primary objective of the smart city vision is opposing the environment protection and social equity promotion. As economic growth relies on increased demand for material resources, which runs to environmental degradation (Martin et al., 2018).

Tab. 1 Six dimensions of Smart City Concept

Smart Economy
Smart People
Smart Governance
Smart Mobility
Smart Environment
Smart Living

Source: Giffinger et al., 2007: 11

Brownfield transformation into smart districts

At the European level, the concept of smart city is linked to the development of industry and establishment of an industrial activity in 2011 called Smart Cities and Communities. Connected to that, one year later, the European Innovation Partnership for Smart Cities and Communities (EIP-SCC) was unveiled. The EIP-SCC concept is conjoined with the energy issues, transport, information, and communication technologies. An example could be a construction of a smart district with a positive energy balance. The European Innovation Partnership for Smart Cities and Communities points out the limited resources of European cities and proposes as a good practice sharing of experience and best practices in the implementation of smart cities (European Commission, 2012). European cities receive funding within the so-called lighthouse projects. Cities involved in these projects could be either lighthouse cities or fellow cities. Lighthouse cities are an example and inspiration for fellow cities. Seventeen projects have been funded under SCC since 2014, bringing together 46 lighthouse cities and 70 fellow cities. In the Czech Republic, Prague has experience as fellow city from the Triangulum project and Brno takes part in the RUGGEDISED project. Cities involved get inspiration how to transform existing neighborhoods in low-energy smart districts (SCIS, 2020).

Brownfield revitalization and its transformation into a new urban district is a change in urban planning. In the past, new satellite towns used to be constructed in the city suburbs but now former industrial zones constitute a potential to become urban districts. These complex districts, usually situated in the city centres, should comprise all necessary services for common daily life such as shops, schools, apartments and offices. The concept of smart district is a new phenomenon in sustainable urban development and brings a higher value to the city development. In literature, many authors focus on energy aspects concerning the transformation of districts (Mattoni et al., 2019). The positive energy district is a common objective in various EU research project (Brozovsky et al., 2021), and the European Commission presents smart districts as "*positive energy blocks/districts, which consist of several buildings (new, old or a combination of both), that actively manage their energy consumption and the flow of energy between them and the wider energy system. Positive energy blocks/districts have annual positive energy balances (European Commission, 2018:106)*." Besides form the others, Gehrke and Welch (2017) conducted the research of the built environment on activity participation and pedestrian travel within the case of Portland Metropolitan Area. The concept of smart district may be connected in the literature with an emerging concept of net zero energy community (NZC), which is still restricted to the scientific literature review (Koutra et al., 2018). According to Carlisle et al. (2009), the NZC is a community, which generates at least 75% of its energy demand through

renewable energy sources. The difference between low-, nearly or zero energy/carbon buildings and positive energy neighbourhoods/districts/blocks is in the capability to energy storage and flexible way of renewable energy generation (Brozovsky et al., 2021). Moreover, Brozovsky et al. (2021) assume, based on the literature analysis, that the most frequently used CFN concept is Zero Emission Neighbourhood, followed by the term Positive Energy District, which are usually connected to the concept of Smart city.

What makes smart districts specific, and what are the benefits for conventional brownfield regeneration beyond today's modern city? Definition above mentioned shows that smart districts are parts of cities that actively manage their energy consumption. However, the district will not only become smart thanks to the technology but the key is to think smartly about it. The municipality implementing such a district should approach the planning process responsibly and involve stakeholders, including the public, in the planning. The smart districts construction contributes to solve the problems of the shortage of flats or their high prices in the real estate market, either through the construction itself or through the regulated rents. Smart district can be realized on a so-called greenfield or on the site of a former industrial activity in a disused area. Last but not least, smart districts can be used as test sites for new technologies, which can be later installed in the rest of the city. Smart district constitutes for the city an opportunity to increase the city's attractiveness, improve the living conditions and to be further developed.

The European smart project of this type has grown at the place of former airport in Vienna and is called Seestadt Aspern. Similarly, in the Czech Republic the project of smart district Špitálka is being negotiated at the place of former heating plant Teplárny Brno. The transformation of the former post office sorting centre is being implemented in Bordeaux, France, as part of the Bordeaux Euratlantique project (Bordeaux Euratlantique, 2020; Brno Brno City Chief Architects Office, 2019; Rainer et al., 2010; Orehounig et al., 2014).

DATA AND METHODS

This work is methodically based on desk research method of available information about both brownfield revitalization concept and the smart city phenomenon. Case studies of brownfield transformation into smart districts in selected cities are analysed in this paper. Comparative analysis is used to draw a comparison between selected case studies. A semi-structured interview with experts on the districts in Brno, Bordeaux and Vienna was carried out in order to obtain information not only about smart districts but also about smart cities in general. Then the synthesis of the obtained information is performed and the recommendations for the Brno Špitálka project are defined.

Qualitative semi-structured interviews were held face to face on March and April 2019. The author interviewed the manager of the Špitálka area from the City

of Brno and an architect of the City of Brno, who participated in the Špitálka project. The author also visited the heating plant Teplárny Brno during the Openday. Then the author visited the Bordeaux Euratlantique district, including the information centre of the project, where the author had an interview with local officer. Later on, an appointment with the manager of the Wien 3420 company was carried out in the Seestadt Aspern information centre. The questions of qualitative interviews focused on general information about the projects, financial sources, property relations and possibilities of affordable housing units in the discussed districts.

The city of Brno is considered to be a good example in the field of smart city for many reasons e.g., it is the winner of ITAPA 2018 AWARD in the category of Visegrad countries, organizer of the fourth year of Smart city fair URBIS and last but not least Brno is known for practical application of Quadruple helix model (Jaňurová, Chaloupková and Kunc, 2020). Vienna is considered to be the smartest and most liveable city, according to international rankings (Madreiter et al., 2021), moreover the smart district project is being implemented on former airport brownfield site. The brownfield revitalization as part of smart district also takes place in Bordeaux, which is similar to Brno according to the number of population size. In addition, these are all university cities together with Vienna.

The option of selected cities is based on several factors and the choice of case studies was consulted with experts on smart city issues from the City of Brno. Despite the fact that all the cities described have different population sizes, they are to face similar problems, such as increasing urbanization, high-energy consumption or the pressure to reduce greenhouse gas emissions. Brno benefits from its historical connections with Vienna and its proximity to the centre of the former Habsburg monarchy (Vyskočil, 2014). Subsequently, Vienna is considered as a model for Czech cities owing to the common historical, cultural and social developments. The City of Brno representants take inspiration from selected European cities (Vienna and Bordeaux), which they have visited, including the described smart districts.

CASE STUDY AREA: SMART DISTRICT IN BRNO, CZECH REPUBLIC

In the Czech Republic, the phenomenon of smart districts is a relatively new issue and due to limited planning possibilities, a suitable tool is the cooperation with foreign cities and drawing inspiration from good practice. In the future, the brownfield area of the unused western part of heating plant Teplárny Brno will be transformed into a modern smart district called Špitálka. This area is located in the city centre of the second largest city in the Czech Republic – Brno is an example of a city that has undergone a transition from a centrally planned to a market economy. There is however a question in which moment we consider the adaptive transformation to be complete and call further development as the normal regime of a capitalist city (Matlovič, 2014). The Špitálka project's objective is to create

a neighbourhood, which is environmentally friendly and offers new housing units, creates new jobs and services. Another objective is to verify the use of new information and communication technologies and their spread to the rest of the city (City of Brno, 2020).

Fig. 1 Panoramic view of the Špitálka area
Source: The author's own photo from the Openday of heating plant Teplárny Brno. 30. 3. 2019

The Špitálka smart district project was part of the first Action plan for the period 2018-2020 of the Brno 2050 strategy. The City of Brno is a member of the RUGGEDISED (Rotterdam, Umeå and Glasgow: Generating Exemplar Districts In Sustainable Energy Deployment) consortium, thanks to which it receives financial contributions from the European Union for financing the Špitálka project. Brno represents together with the cities of Gdansk and Parma the so-called fellow cities and learn from Rotterdam, Glasgow and Umeå how to reduce the energy consumption of buildings or how to implement intelligent technologies or use available data (Brno, 2019). The data obtained is also used for the smart district project Špitálka, which should be created in the unused part of the former heating plant area. The RUGGEDISED project shows "*how to transform existing districts into low-energy, accessible and community neighbourhood. This project focuses on reducing the energy consumption of buildings, increasing the use of renewable energy sources and electric vehicles, the introduction of intelligent energy management technologies or the use of available data in urban development planning (Brno 2050, 2018:38)*." According to the opinion of local inhabitants, that area requires the transformation. Thanks to the construction of a smart district in this neighbourhood, the quality of life would improve and its attractiveness would increase. The RUGGEDISED project manager from the City of Brno describes the project a follows: "*The goal of the project is for the lighthouse cities the direct implementation of smart measures in selected locations and smart districts. Concerning the fellow cities, the goal of the project is to learn from lighthouse cities and prepare its own location for future investments and implementation of smart projects and measures*."

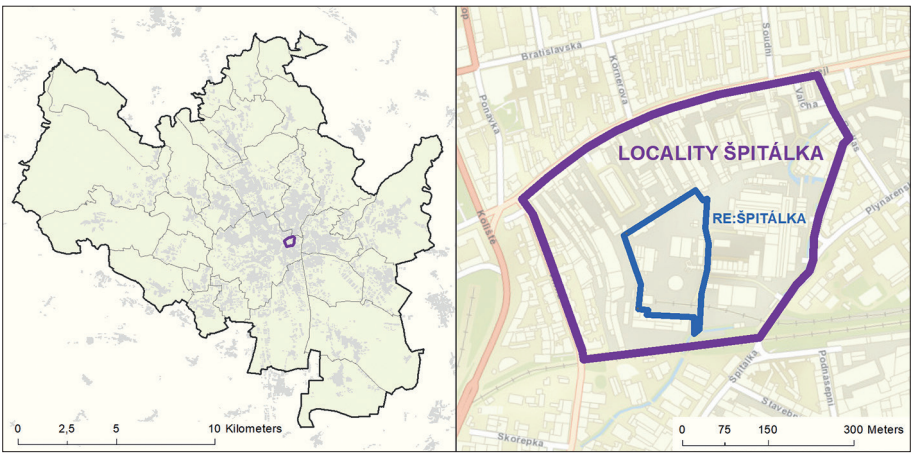

Fig. 2 Location of the case study area Špitálka
Source: The author's own processing

Local inhabitants of Brno do not feel well in this area and consider it as a place that needs to be changed. The manager of the RUGGEDISED project adds: "*The land is suitable both for its size and for its property relations. This site is owned by a municipal company, which is wholly owned by the City of Brno. Due to the attractive location of the whole area within the city and its not very good current state, any investment in this area is more than desirable (Archspace, 2018).*" According to the examiner of the competition proposals of the international urban idea competition Špitálka form the Office of the Architect of the City of Brno, the strong features of the project is: "*the verification of possibilities of application of new principles and technologies. The location is in an ideal location, which has both a sufficient supply of existing job opportunities and new job opportunities in the new district. Then the proximity of the historic centre is certainly a strong point. Another strong point is also the economic benefit, thanks to new jobs, in addition, start-ups or areas for small businesses are being considered.*"

The Špitálka project is led by the City of Brno, which has been creating the smart city Brno concept since 2014. The special post of a development site manager was established at Department of data, analysis and evaluation within the Strategic development and cooperation department. An international open one-phase urban design idea competition was announced by the City of Brno and organised by the City chief architect's office, another important stakeholder involved within this project, in cooperation with Data, analysis and evaluation department of the City of Brno. Subsequently, the Heating plant of Brno plays an important role when negotiating about the future smart district Špitálka. As the area of 2.5 hectares, which is the subject of the RUGGEDISED project, is currently owned by the municipal company the heating plant Teplárny Brno.

The smart district Špitálka project in Brno has ambitions to reduce mobility through the construction of housing units, social services and shops in one place. The emphasis on sustainable mobility, the promotion of public transport and both cycling and pedestrian paths is a necessary factor in urban renewal. Thanks to smart urban planning, individual car traffic is reduced owing to the construction of facilities for the daily needs of the population in one place, moreover that eliminates negative externalities in the form of environmental pollution or daily time spent in the traffic transports (Brno City Chief Architects Office, 2019). According to Klusáček et al. (2020) the successful regeneration of the Špitálka brownfield area has the potential to be a good example of a smart district project for other localities in the Czech Republic.

The architectural studio Atelier 8000 presented the design of the future smart district in the form of a so-called Master plan. It counts on the use of existing buildings and the preservation of the industrial character of the place. The storey building of the former archive and the two-aisle industrial hall will be transformed into a venue for social and cultural events and a co-working centre. The iconic cooling tower will offer space for presentation and a unique view of the new district and the nearby city centre. The new development will then offer housing for up to 900 people. In the Master plan there is the so-called „skywalk" which connects all buildings and passes through the cooling tower. The skywalk will become an important symbol of the transformed brownfield thanks to the walks through the greenery roofs, sports grounds, and gardens of inhabitants of buildings. Moreover, massive greenery on the roofs will also contribute to reducing the heat load of the site (City of Brno, 2020).

Fig. 3 Master plan of the case study area Špitálka
Source: City of Brno, 2020

EXAMPLES OF EUROPEAN SMART DISTRICTS: VIENNA AND BORDEAUX

An important urban project for the construction of a smart district is being implemented in Austria the capital of Vienna, where the Seestadt Aspern district has been built since 2009. The name was given to this project after the lake, which was created by filling the former sandpit with ground water. According to the Master plan this development project is being realized on the area of 240 hectares and should be finalized by the year 2029. The new district of Seestadt Aspern, located in the northeast of the Austrian capital in 22nd district is called as a city-within-a-city, which tends to be a good practice for other urban projects (Orehounig et al, 2014).

Fig. 4 District Seestadt Aspern in Vienna
Source: The author's own photo

The urban project of Seestadt Aspern is managed by Wien 3420 Aspern Development Agency, which is a private institution founded for a period of 25 years partly by public entities, who were former landowners. The Wien 3420 represents the private part within the public private partnership with the city. In spite of representing big players in the real estate market in Austria, they do not have enough capacity to build a team of people for the next 25 years of project development. Wien 3420 represents a group of 25 members, whose main task is to coordinate the planning processes of the Seestadt Aspern project. Wien 3420 announces competitions based on Swedish architect Johannes Tovatt's Master plan from the year 2007. The winning design is chosen by the jury, where the decisive element is not only the price, but the emphasis is on design and functionality. The composition of the jury varies and is not a condition to put in it each time a member of Wien 3420.

The Siemens company is involved in the Seestadt Aspern project to bring into it the technical expertise. Siemens carries out technical solutions within the Aspern smart city research project. In the first phase, three types of buildings were chosen to be studied. The technical elements for the future of energy were installed in a residential building, in a school campus and in a student dormitory.

The aim of this project is to find out which measures are meaningful, acceptable and what are the technical needs of each type of building. The objective of the ASCR is to optimize its own consumption in the building. The project is planned to be extended to the northern part of the Aspern project (Smart City Wien, 2020).

Vienna has ambitions to build both blocks of flats and office spaces, educational institutions and student dormitories in one place. The district is built with the aim to make walking and cycling as pleasant as possible, another goal is to maximize the use of public transport compared to private vehicles. The smart district Seestadt Aspern is expected to be completed in 2029.

Fig. 5 Bordeaux Euratlantique
Source: The author's own photo

Another European project of smart district is realised in the land of the Gallic rooster. Bordeaux Euratlantique is one of the largest urban projects in France with an area of more than 730 hectares in Bordeaux and the municipalities of Bègles and Floirac. An important part of the project was the construction of a high-speed train connection of the Paris-Bordeaux line, thanks to which these two metropolises are about two hours away. In 2010, the Bordeaux Euratlantique public planning and construction institution (EPA Établissement public d'aménagement Bordeaux Euratlantique) was set up to manage the entire project. However, it is necessary to mention that this is not only the construction of a common district but a modern district that includes smart elements such as low-energy construction of wooden towers not only for housing units. Not only are new buildings being built there but the project also includes the reconstruction of brownfields such as the former post office sorting centre into a congress centre (Bordeaux Euratlantique, 2020).

The Bordeaux Euratlantique project representative describes the project as follows: "*the construction of offices, residential blocks and schools is planned. However, land must first be purchased, either from the town hall, from individuals or from companies. The land must be therefore bought from landowners. Then, the demolition or the remediation can be carried out as required and the underground services can be installed.*" Resources for financing the Bordeaux Euratlantique project

are accumulated from the profits from the sale of real estate to developers. We call this method of financing "financial leverage effect" – Bordeaux Euratlantique buys from landowners, that is from municipalities, individuals or companies, the parcels, which it then sells to selected developers for an amount slightly higher than the one for which it acquired the land. The costs of underground services installation, reduction of environmental pollution, maintenance, survey or construction of public spaces are covered by the sale of already networked land and collected taxes associated with the construction. Moreover, local authorities (municipalities, departments and regions) fund public facilities such as schools, gyms and libraries. Private investment is estimated at 8 billion euros (Bordeaux Euratlantique, 2020).

The EPA institution has published an evaluation report on the duration of the project from the year 2010 to 2019, in which it evaluates individual sub-projects, including the successes and difficulties associated with it. The mobility section of this report describes the approach to the construction of new parking spaces. Despite the fact that the number of cars per household in Bordeaux decreased from 0,65 in 2009 to 0,45 in 2014, the model of car ownership persists. During the Bordeaux Euratlantique district construction, EPA must respond to the current requirements of the district's residents, employees and traders and anticipate a reduction of vehicles used in the future. EPA aims to reduce the ownership of parking spaces, encouraging their rental or shared rental. As for example, a parking lot with a size of 400 parking spaces has the potential to serve 20 to 40% more drivers as its size. Thus, the inhabitants of the district commuting to work would alternate with those who come to the district for work (Bordeaux Euratlantique 2019:108).

COMPARISON

In the following table, there is a comparison of basic information about discussed smart districts. That is the construction period, district's area, estimated number of inhabitants or estimated number of new jobs in Bordeaux Euratlantique, Seestadt Aspern and in Špitálka. The foreign smart districts represent only the auxiliary examples for the Czech future smart district Špitálka in Brno. Seestadt Aspern and Bordeaux Euratlantique comprise the sources of good examples for building the case study smart district Špitálka in the Czech Republic. The uniqueness of Špitálka district lies in its location right next to the city centre and comparing to the other discussed smart district, it is projected on a relatively small area. Seestadt Aspern is a district with a relatively low density. As the number of inhabitants per household is projected to be less than two people in this Viennese district. Yet in Bordeaux smart district, such estimation is about two and half people per household. We assume high density of Czech district Špitálka due to its built-up surroundings – this number should be about three inhabitants per household

according to the projections. Planned number of inhabitants per square kilometer is 36 000 people in district Špitálka, that is more than in Seestadt Aspern (8 333 people per square kilometer) and in Bordeaux Euratlantique (6 775 people per square kilometer).

Tab. 2 Case studies comparison

	Bordeaux Euratlantique	Seestadt Aspern Vienna	Špitálka Brno
Date of construction	2010-2030	2009-2029	After 2023
District's area	738 ha	240 ha	2,5 ha
Number estimation of district's inhabitants	50 000	20 000	900
Population density	6 775 inh/km^2	8 333 inh/km^2	36 000 inh/km^2
Number estimation of new jobs	30 000	20 000	50-100
Planned number of housing units	20 000	12 100	250-300
Led by public institution	yes	no	yes
Existence of brownfield area	yes	yes	yes

Source: City of Brno, 2020; Bordeaux Euratlantique, 2020; Orehounig et al., 2014; author's own compilation

DISCUSSION

The exchange of good experience and practice is an efficient way for cities and municipalities to improve the quality of life for their inhabitants (Glasmeier and Christopherson, 2015; Klusáček et al., 2020). That is the idea of the lighthouse projects of the European Union and its part the RUGGEDISES consortium in which the City of Brno is involved. For the so-called fellow cities it is also important to know the failures of more advanced lighthouse cities in the process of smart cities elements implementation. Moreover, the Czech Republic and other Central and Eastern European countries were going through the period of transformation and the coming of new technologies was decelerated. The city of Brno constitutes a secondary city in post-socialist space (Klusáček et al., 2020) due to its population size. Other Central and Eastern European cities should take advantage of joining the lighthouse projects of European Union and try to test western experience for the regeneration of the post-socialistic urban space.

Modern technologies do not make a district to be smart or a city does not become immediately intelligent. As the key to the success is to think cleverly about things and approach the planning process responsibly (Hollands, 2008). The whole area of Špitálka project that is negotiated within the RUGGEDISED project and is a subject of Master plan, is 2.5 hectares large. Focusing first on the local part of the whole is a sign of tactical urbanism, which emphasizes flexible (tactical) tools to improve urban life. Tactical urban planning activities are considered as experimental labs and, when proven, could be implemented in other parts of the city (Yassin, 2019). Moreover, we should look at the Špitálka project as a living organism that means to create an environment, which is full of life and interactions. The city of Brno should ensure the diversity of retailers in the new districts, with the preference of local producers and local food over big supermarket chains. In addition, the self-sufficient city district supports small business and the planners should not either forget to include in such a district the co-working spaces and facilities of sharing economy, which is also a hallmark of a smart society, based on renting, lending, sharing or exchanging products. Such services of shared economy strengthen the trust among people, accelerate the formation of social relations and improve the cohesion of city districts.

The City of Brno cooperates within the Špitálka project with the Six research centre form the Brno University of Technology, which processes technical studies of energy and water infrastructure, district heating, sharing economy, waste recycling, etc (zVUT, 2018). This cooperation is assessed positively but it is considered important to establish the cooperation also with the private sector as part of the Špitálka project. According to the manager of the development project Špitálka, the City of Brno aims to develop such cooperation with public sector through smart vouchers and should establish a better cooperation within the public private partnership. One of the possible ways is to take inspiration from the Aspern Smart City Research, in which Viennese municipality cooperates with the Siemens Company that optimise the energy consumption in selected facilities within the Seestadt Aspern. This project of public private partnership could be replicated in Špitálka project.

Another example of the public private partnership within the smart district construction is the Wien 3420 Aspern Development Agency, that itself oversees the whole Seestadt Aspern project. Wien 3420 is a private organisation founded by public entities that did not have the capacity to manage the entire project for 25 years. This subject is responsible for the business plans and announces competitions (Smart City Wien, 2020). Cooperation of Czech municipalities with the private sector in the implementation of brownfields regeneration projects is not very frequent and at such a level as in Vienna. Exchange of good practice and cooperation between cities are a good way to equalize this deficit.

Financing the project

The Špitálka smart district project is financed from the RUGGEDISED project, specially, for example, the costs of the project coordinator, etc. The City of Brno itself also finances the smart district project because mainly its own resources pay the Brno smart city concept. One of the possible variants is to obtain the status of a so-called lighthouse city for the city of Brno and the subsequent involvement in a new consortium. However, the City of Brno would also have to meet certain conditions, which usually differ within each call – such as choosing a site to work with renewable energy sources or charging stations for electric cars. The city should also have developed the Sustainable Energy and Climate Action Plan (SECAP), which was finished for Brno in 2019 (European Commission, 2016).

According to the abroad experience, the essence of financing the smart district project is based on the principle of the so-called financial leverage effect, no matter the project is managed by a public entity or a private institution. Funds to cover the underground services installation, possible demolition of buildings or the building renovation are covered from the accumulated capital from the sale of land to developers. Based on the findings of functioning the smart district financing abroad that is the financing projects through the accumulation of capital from the sale of land, the author recommends the city of Brno to discuss the issue of property relations with heating plant Teplárny Brno. Although the City of Brno is the sole shareholder of this municipal company, it is necessary to address this issue.

As already mentioned, the city of Brno is currently a member of the RUGGEDISED consortium as a fellow city and could become a lighthouse city for the next period. One of the conditions is that there are energetically passive houses in the discussed area. Špitálka project has the prospective political support of the Government of the Czech Republic (Klusáček et al., 2020) because it makes part of the so-called National Investment Plan of the Czech Republic for the period 2020 – 2050 (City of Brno, 2020).

Other recommendations

Based on a personal visit and interviews with involved representatives from Maison du Projet de Bordeaux Euratlantique information centre and the Seestadt Aspern project information centre at Wien 3420 company, the author recommends setting up an info point at the Špitálka smart district project, including the presentation of the Brno smart city concept itself. The information centre could be located at the no longer used premises of the Špitálka heating plant Teplárny Brno, which would also open to the public the so far inaccessible areas. That area would find a temporary use, similar to the former Káznice complex, where cultural events are held. This option would be similar to the Bordeaux project information centre, located separately in the Bordeaux Euratlantique district, the opening hours are from

Wednesday to Saturday and the public will receive information materials or view the project model. The second option is the Seestadt Aspern project information centre, which is located in Aspern, also in the district itself, but in addition, the Wien 3420 project coordination unit is located in the same building. It is possible to make an appointment with experts or to see the model of Seestadt Aspern district. In the next room, there is also a centre for the Aspern Smart City Research project. If the model of the Špitálka future smart district and the information point for the project were located in the building of the City of Brno, where we will also find the offices of experts from the smart city concept, a special post would not have to be created for a new employee of the information centre.

CONCLUSIONS

Sharing experience, knowledge and exchange of good practice are important for the cities in the process of implementation smart city's elements due to their limited resources (Glasmeier and Christopherson, 2015; Klusáček et al., 2020). The City of Brno is a fellow member of RUGGEDISED consortium (Brno, 2019), in which the City of Brno gets the inspiration from other cities how to build low-energy districts, the so-called smart districts (Brozovsky et al., 2021; Mattoni et al., 2019). The author undertook the study trip to Bordeaux and Vienna to obtain the necessary information and get to know the atmosphere of the Bordeaux Euratlantique and Seestadt Aspern districts. In addition, the author visited the heating plant Teplárny Brno. In the table 3 there is a summary of key words defining examined smart districts.

Tab. 3 Summary of key words defining examined smart districts

Seestadt Aspern Vienna	Bordeaux Euratlantique	Špitálka Brno
Energy efficiency planning	TGV station	RUGGEDISED consortium
Affordable housing	Shared rental of parking lots	Heating plant
Non-profit developer	Information centre	Cooling tower
Former airfield	Public development corporation (EPA)	REbuild, REdesign, REnew, REcycle, REvitalise

Source: The author's own processing

The urban project Špitálka in Brno is a case study from Central and Eastern Europe realizing the transformation of urban brownfield site into a modern smart district reflecting the unique genius loci of this industrial quarter. As one of the hallmarks of the city of Brno and projected smart district itself is the cooling tower, that will be kept in its original state according to the Master plan. The discussed area is built-up, located just next to the city centre, and projected population

density is 36 000 people per square kilometer, which is more than in smart district Seestadt Aspern and Bordeaux Euratlantique.

Brno takes part in European project called RUGGEDISED consortium. This so-called lighthouse project figures as a platform enabling the exchange of experience among its members, who are above all supported from European funds. Constituting a secondary city in post-socialist space, Brno represents an example for other Central and Eastern European cities, which should also participate in European lighthouse project and learn from other more experienced cities of how to regenerate the post-socialistic urban space.

Besides the cooperation within the lighthouse project, politicians from the City of Brno communicate with relevant representants of Seestast Aspern smart city project from Vienna. Yet, another partner of the City of Brno are the politicians in Bordeaux responsible for the Bordeaux Euratlantique project. An example of good practice called ASCR is implemented in Vienna. In this project of public private partnership Viennese municipality cooperates with the Siemens Company about the energy consumption in selected facilities within the Seestadt Aspern. Simmilar project could be replicated in Špitálka smart district.

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