ENHANCING WELLBEING IN PUBLIC URBAN SPACES THROUGH TECHNOLOGY: A CASE STUDY OF ADA HUJA, BELGRADE

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ABSTRACT

Integrating technological solutions into public open spaces allows for better space management by creating more pleasant environments for leisure and recreation. In recent years, there have been more and more such solutions worldwide. Innovations are supported both at the smallest scales of urban design and in planning. Using these innovative principles, this paper explores how technological solutions can transform and improve the recreational areas of Belgrade – Ada Huja, to support the overall well-being of its users. Studies confirm that this can be achieved by promoting increased physical activity, mental relaxation, and social interaction. This paper emphasizes the use of smart urban and recreational equipment, sensors that track and adapt to the environment, and sensors that manage the environment. The research is based on a qualitative approach, which includes a case study of Ada Huja in Belgrade, Serbia, and examples from practice in which technology has been used to enhance public parks. This paper aims to define the importance of improving the quality of space, using technology as a tool, while maintaining or improving its ecological aspect. The research also provides guidelines for planners and urban designers of Belgrade to form better solutions for increasing user satisfaction in recreational spaces in the future. The results show the importance of integrative planning and design, adapted to the local context, using technological innovations for the design of spaces with better ecological characteristics, spaces that are socially inclusive and that promote well-being.

KEYWORDS _ *Technology, Well-being, Public spaces, Ecological sustainability*

INTRODUCTION

Modern cities increasingly rely on technological innovations to improve the quality of life of their residents. Technology in recreational public spaces can contribute to better space management and create a more pleasant overall environment for leisure, socializing, and other activities. An increasing trend can be observed in the implementation of smart urban equipment, sensors that monitor and adapt to the urban space, and various digital platforms for use monitoring with the help of smartphones and GPS systems. Outdoor recreational activities have been proven to be beneficial for people's well-being, compared to indoor exercise (Thompson Coon et al., 2011). Well-being is often associated with the concept of health in the literature and is defined as a positive physical, social, and mental state (Summers et al., 2012). The measured factors depend on the focus of the sources that use them. Certain initiatives and development indices measure economic factors and social ties (The Australian Unity Well-being Index, 2002), other health factors, physical and mental health, and quality of life (The Canadian Index of Well-being, 2012). In urban spaces, well-being consists of the quality of the space and the opportunities it provides, such as the presence of nature, contact with nature, and physical activity (Hartig et al., 2014). Digital technologies can play a key role in improving these factors. In the context of Belgrade, Ada Huja represents a unique but underused recreational area. In addition to its riverside position, it has a complex functional structure and social-ecological and economic problems. Industrial facilities, pollution, and unsanitary settlements compromise recreational space. For the area of Ada Huja, the implementation of innovative technologies can include the creation of interactive paths, exercise areas, playgrounds, guides through the history or ecology of the space, which will facilitate use and motivate users to actively enhance their own well-being. Moreover, technological solutions can greatly increase the ecological quality of the space, which further affects the well-being of users. This paper investigates how innovative technologies in sports and recreational spaces contribute to the well-being of users, with the Ada Huja area as a case study. Through the analysis of the current state of this area and a comparison with successful global examples, the paper provides proposals for the improvement of the local context through digital innovations. The focus is on the possibilities of improving physical activity, social interaction, contact with nature, and the feeling of belonging and inclusion in the space as the main factors on which recreational environments can increase the well-being of their users.

METHODOLOGY

The research is qualitative and focused on two main parts. After the initial literature review, the research focuses on a case study of Ada Huja, to better understand the starting point and needs of the users of this area. Through an explanation of its specific situation and the emerging problems, the research defines the places of greatest potential for improving the well-being of users through technology. The data was collected from various sources, including the Urban Planning Institute of Belgrade, the Palilula municipality website, and other relevant city internet sources. The analysis focuses on the functional, ecological, and social characteristics of Ada Huja, which are considered the most relevant for users' well-being. Next, the paper offers a review of positive examples from global practice, which enhanced the use of space and well-being of people through technological solutions in public parks. The examples were chosen precisely according to the relevance in the implementation of technological solutions, which are functionally similar to the area of Ada Huja - parks and sports and recreational areas. The data was collected from the official websites of the cities where these spaces are located, as well as from documents of relevant planning institutions and various internet sources. The first selected example is the Busan Citizens Park from South Korea, which shows how digital solutions can improve the user experience by applying various technological solutions in the design of the park. The second example is the Queen Elizabeth Olympic Park in London, whose SHIFT program integrates smart sensors and other digital tools to monitor environmental and climate conditions, human movement, and other factors. Both examples are analyzed as illustrative cases

that can help in finding adequate solutions for the space of Ada Huja. Learning from these two global examples, the research proposes specific strategies and recomendations for enhancing the well-being and ecological characteristics of Ada Huja and its users.

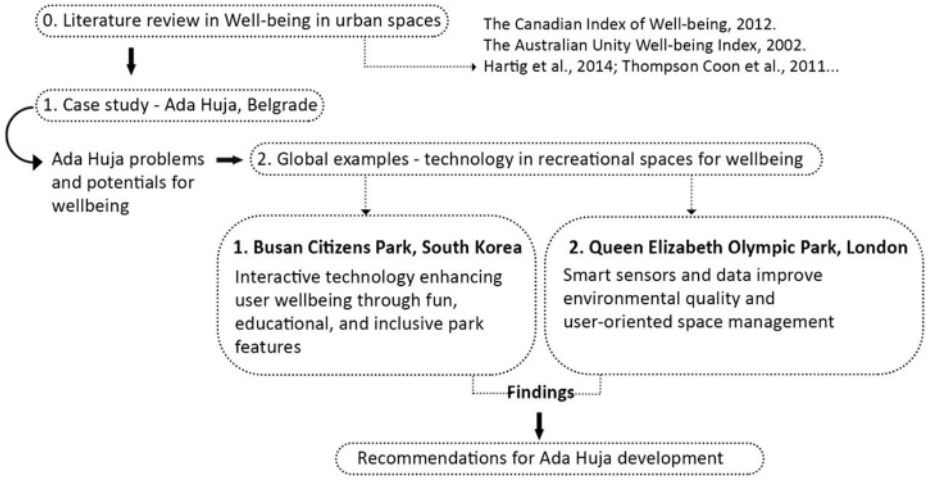


Figure 1: Methodology diagram (authors illustration)

THE CASE STUDY OF ADA HUJA, BELGRADE – LOCAL CONTEXT

Ada Huja is part of the Palilula municipality in the city of Belgrade. It stretches along the right bank of the Danube River, between the "Pančevački" bridge, Karaburma settlement, Rospi Ćuprija, and Višnjićka Banja. Geographically, Ada Huja is a peninsula with a backwater inlet, which was an island in the past but has since been annexed to the mainland. Since the 1950s, Ada Huja has been defined as an industrial zone, and later it was also used as a city landfill (Gligorijević, Graovac, 2018). The landfill occupied the area of Ada Huja from 1960 to 1970, and although it was later moved, the issues of rehabilitation and regeneration of the area have not yet been fully resolved. Since 2010, various initiatives of governmental and non-governmental organizations have resulted in the partial clearing of waste, as well as the creation of a well-organized shoreline of the fort and recreational and service facilities, such as parks, fields, restaurants, cafes, and the like. Today, while the indoor facilities are very popular, the outdoor recreational space remains underutilized. The largest effort was directed at the rehabilitation of the land at the "top" of the peninsula, an initiative of the Supernatural Festival, which was held at this place and promoted the ecological quality of the area, healthy use, and recreation in nature (Moja Srbija, n.d.). In an ecological sense, the area is rich in thermal groundwater (GUP, 2041). The backwater zone has stagnant water with no natural outflow, which contributes to pollution. The Jaroslav Černi Institute (2015) confirmed the presence of zinc, chromium, arsenic, and hydrocarbons in the water. The unenviable environmental situation is reinforced by the effects of the existing unhygienic residential area in the west, the storage and storage areas, as well as the Smurfit Kappa cardboard factory in the center of the area - right next to the coastal recreation area and the promenade. Air quality is often compromised due to cardboard processing. In a functional sense, the recreational area of Ada Huje occupies a very small percentage of the total area, and it borders the economic area of the factory, commercial contents, and undeveloped areas (figure 2a). The new plans for Ada Huja envisage the creation of a new park-forest along the banks of the Danube. Such plans have so far only been presented conceptually, although in the new general plan of Belgrade for 2041, as well as the new general regulation plan, this area appeared under the classification of "park-forest"

and “afforestation”. Such development can be beneficial for the area, especially if the new sports and recreational green areas of the park-forest fit with the paradigm of technological solutions, which can additionally improve the ecological characteristics of the area and increase the well-being of future residents (Figure 2b). Positive examples from practice, which will be focused on the development of the area with the application of innovative technologies, will be selected according to the newly planned development of the area - with a focus on the improvement of parks and green sports and recreational areas.

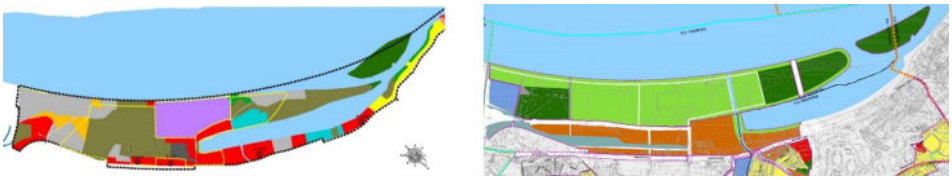


Figure 2a and 2b: a)Plan of land use for Ada Huja, Source: Detailed Regulation Plan for Ada Huja, Early Public Review, Existing Conditions, Urban Planning Institute of Belgrade. b) Planned new land use for Ada Huja. Source: General Regulation Plan for Ada Huja, Urban Planning Institute of Belgrade

The existing recreational area, the promenade, is about 1 km long. Sports and recreational facilities are lined up along the promenade. Public recreational facilities include a skate park, basketball courts, and a children’s playground. Among the private amenities in the area, there are private tennis courts for rent, as well as a go-kart track. Public sports and recreational facilities are underused, contributing to poor maintenance and neglect. The promenade is relatively frequented, with daily walks and fishing by the elderly (figure 3).



Figure 3: Sports and recreational spaces in Ada Huja; Private tennis courts, playgrounds, fishing (author’s photographs)

TECHNOLOGICAL APPLICATIONS IN URBAN PARKS: GLOBAL EXAMPLES

Busan Citizens Park, South Korea

The first selected example of a park designed with the use of technological innovations is the city park in Busan, “Busan Citizens Park” in South Korea. This example was chosen because of the similarities it shares with Ada Huja. First of all, the area is rich in history. The location of the park was previously a camp of the Japanese Imperial Army as well as a camp of the United States Army called “Camp Hialeah”. It lost its military function in 2006, with the beginning of the transformation into what it is today. Similar to the area of Ada Huje, this site was once located on the outskirts of Busan, but in the meantime, with the development of the city, it has become a very desirable location. The reactivation of the former military area into a large sports and recreation space, about 54 hectares in size, also required the remediation of contaminated land, which delayed the opening of the park to the public until 2014. These two spaces also share the similarities in the presence of water. In the city park of Busan, two streams were ecologically restored, and a new lake was formed as an additional

natural element. The park was designed based on five main themes: memory, culture, pleasure, nature, and participation (Busan Metropolitan City, n.d..). It aspired to become the first "U-park" or "Ubiquitous Park" - a park where technology is subtly present everywhere. In the context of user safety, 42 CCTV smart cameras have been installed, monitoring all parts of the site (Busan Citizens Park, n.d..). In case of emergencies, this surveillance system automatically sends a call to the fire or police stations. In order to improve the use of the park, as well as to extend the time of the user's stay in nature, online connection is enabled in all parts of the site via Wi-Fi. Biodiversity is enriched with over 13,000 tree trunks and one million shrub and flower seedlings, which can be learned and explored through the QR codes placed on the trees and next to the seedlings. The quality of greenery is monitored by technologies such as the "RFID" system, which allows wireless management of the ecological quality of the space (Busan Citizens Park, n.d.). In addition to the management system, small-scale technologies, such as smart benches, 4D cinema, and a "Multimedia wall", which are based on the most modern IT technologies, have been implemented in the park. Nightly projections of light shows were also implemented in the area of the newly formed lake. The quality of this park was recognized through already existing studies dealing with well-being and technologies, where the authors concluded that within the park, the most used spaces were where multifunctional innovative design solutions were implemented (Jun, 2023). This confirms the values that could be transferred to the space of Ada Huja in enhancing the feeling of belonging to the space, increasing physical activity, and the feeling of security of the users, all of which affect people's well-being.

Queen Elizabeth Olympic Park (QEOP), London, UK

"Queen Elizabeth" Park represents a well-known but interesting example of the use of technological innovations in the form of a system for monitoring and improving the climate conditions of public spaces, ecological characteristics, and biodiversity, intending to increase the well-being of users and promote a healthier stay outdoors. Located in the area of the former industrial part of the city, which also falls within the scope of the "Lea Valley flowplain", the park got its development potential after the Olympic Games in London held in 2012, on this site. This event began the process of rehabilitation, transformation, and overall revitalization of the area, which included the "healing" of the Lea River within the site. (Planning NSW, Government Architect). The historical industrial function of the land has left significant consequences on the ecological characteristics of the area, especially on the quality of the soil and water. The park occupies an area of about 110 hectares, very similar to the area of Ada Huja. Through the initiative of the companies UCL, SHIFT, and ARUP, known for research and design of technologically and ecologically updated spaces, the "SHIFT digital frontiers" initiative was formed. It aimed to set standards for digital ecosystems in urban parks. "SHIFT" is a model that is currently under development, with a focus on three main strategies: digital integration, inclusivity, and environment - promoting sustainable practices and the health of space users through the collection of usage data (SHIFT Digital Frontiers, 2024). This system is planned to operate both in the area of QEOP from 2024 and in the wider area of East London during the coming decades. The focus is on monitoring weather conditions, energy consumption, water, air quality, and river water level. Sensors have also been installed in the park to monitor the intensity of use of space using mobile phones (wifi and mobile data), event organization, data on the use of facilities, occurrence of heat islands, waste management, lighting, etc. The digital platform is planned to be available to different types of users or stakeholders from different backgrounds (SHIFT Digital Frontiers, 2024). Real-time and physical data could greatly help in space management, in monitoring use, gathering spots, business planning, sports and recreational facilities, coffee shops and other activities that would improve the well-being of residents and the intensive and healthy use of space. Such systems mean a lot to stakeholders because they can plan their investments and improvements based on very specific data that is updated day by day. For users of the space, the platform also plans to use AR simulations, which could increase the enjoyment of staying in the park. For example, based on the collected data, AR simulations could suggest optimal routes with more shade and vegetation to users during hot

days (SHIFT Digital Frontiers, 2024). The combination of collected data with accessible use could be effectively implemented in the local context of Ada Huja to guide users to spaces that would provide them the most positive recreational experience.

DISCUSSION

Historically and contextually, Ada Huja shares many characteristics with global examples. Firstly, all areas previously had a function other than recreational. In the case of Busan, it was a military camp, and in the case of London and Belgrade, it was an industrial zone. The drivers for regeneration and innovation were the expansion of the city and the growth of the area's value, which is a characteristic of both Busan and London. Ada Huja shares the same situation; once marginalized, the idea of the newly planned regeneration and change of function comes from the expansion of Belgrade's urban environment. A large area remains underused and of poor quality. The current user experience, which is limited in the form of poorly maintained and less underused recreational facilities, could be refined similarly to the examples of Busan and London, using modern technologies. First of all, it would be necessary to rehabilitate the contaminated soil and water, similar to the procedure carried out in the QEOP. Preparing this starting point would render the area set for digital management and design technologies. In terms of spatial management, SHIFT's real-time monitoring systems could generate valuable data to optimize user experience and perception of space, as demonstrated in London. The largest problems for Ada Huja are water pollution, soil and air pollution. Therefore, the focus for a system like SHIFT should be on sensors for monitoring the quality of these ecological characteristics. The collected data could be directed towards the daily optimization and improvement of space, which would greatly contribute to the well-being of the users of sports and recreational areas. One of the most important characteristics of well-being in urban areas is contact with nature, so monitoring and management of green areas, trees and other greenery, which have been implemented in both Busan and London, could also be very significant for Ada Huja. All these systems would affect the health and personalization of the user experience and stay by increasing the possibilities that recreational space provides to users. Furthermore, monitoring the number of users via mobile devices and the intensity of use of certain areas could help in planning new facilities within the large scope of the future park-forest, providing data on people's favorite places to stay. It would also be possible to implement small-scale technological design solutions and innovative equipment as applied in the city park of Busan. Active use and physical activity could be promoted through AR education systems, multimedia content, and outdoor cinemas. Also, by installing smart CCTV cameras, the park would ensure a feeling of security in the evening or at night, similar to Busan. Such digital innovations would not only have a positive effect on people's well-being and healthy use of space throughout the day, but also on stakeholders. The range of benefits of technological solutions would be broad. The lack of such solutions in Belgrade is not due to their evident benefits but rather to the complex organization, management, and communication among different stakeholders. Also, a big challenge would be the budget, but through careful planning and long-term phased implementation, the space could come to life and achieve great success. With the help of such solutions, a better inclusivity could be achieved, as well as the possibility of users' participation in the area development, through data collection or organizing joint workshops on these topics.

CONCLUSION

This paper aimed to examine how innovative digital technologies contribute to improving users' well-being in public recreational spaces in the area of Ada Huja through the review of positive examples from global practice. An example from Busan showed how digital technologies can improve the use of space through subtle green management methods and small-scale design interventions, while Queen Elizabeth Park in London illustrated how the implementation of a new management system

can support users' well-being. Ada Huja has the potential to apply both models with careful planning and strategies for cooperation between citizens and institutions. The area transformation could follow the path of applying technologies like the SHIFT system for improvement of recreational spaces, personalization of user experience, safety, better physical activity, and longer and more frequent stay outdoors - which are key elements of well-being. It is necessary to develop pilot projects that would be innovative in our region in cooperation with local institutions. Ada Huja can become a testing ground for these specific digital solutions through interactive guides, sensors, and smart equipment. Participation should be simple and appealing to a wide audience. However, the range of technologies may not be quite sufficient for this area, and the steps of rehabilitation, remediation and repurposing of the space would be complicated, especially in relocating or removing industrial and storage areas. The technological solutions proposed by this paper also do not represent a universal solution. The conclusions are adapted to the local context. For this reason, the paper encourages further research in the rehabilitation and remediation of the soil and waste present in this area in order to prepare Ada Huja for the next steps towards well-being, as well as deepening the knowledge about the feasibility of these proposals in the specific stages of implementation. It is also suggested to involve citizens, in addition to competent institutions, in all phases od planning and design in order to ensure the greatest sense of belonging to the space and user satisfaction. This approach can serve as a model for other similar spaces in Belgrade and beyond, which require regeneration and improvement of user well-being through innovative and sustainable methods.

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