The Role and Potential of Adaptive Reuse of Heritage Buildings in the Multi-Dimensional Upgrade of the Mid-Europe Township Pécs, Hungary, as an Example

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Abstract

Over the last decades, the restoration and rehabilitation of building stock in Europe have been the topic of constant discussion by local and international architects and scholars. In line with this, Hungary has also been seeking suitable urban development which benefits from the urban rehabilitation of the existing building stock. The city of Pécs is the fifth largest city in Hungary, and not only does it have various built heritages covering a long time span, but many of the buildings have also been rehabilitated. This local heritage reuse and rehabilitation which align with the local environmental context, with adaptive functions and forms, are highly valued among architects. Because of this, the city of Pécs, together with Istanbul and Essen, was selected to be the 2010 European Capital City of Culture. This paper discusses, from an adaptive reuse of the built heritage point of view, the impact of adaptive reuse regarding heritage buildings on urban vitality enhancement and the urban built environment in the context of Pécs, through three aspects: (1) district vitality; (2) inhabitants and their corresponding urban habitat; (3) urban connectivity. In addition, the common characteristics of the originally built heritage that is chosen to be adaptively reused are summarized. These findings may contribute to the regeneration and revitalization of the city of Pécs, as well as to other cities with a similar historical background and scale.

Keywords

Adaptive-reuse • Heritage building • District vitality • Urban habitat • Connectivity

1 Introduction

People understand a city initially through the built environment: buildings, streets, squares, and urban public art. Heritage buildings play a significant role in modern cities, representing the cultural diversity and identity of a city as well as often sustaining a local tourism economy. Adaptive reuse is a design strategy in the quest for sustainable cities; it is able to reduce the environmental impacts on the urban environment and give rise to new economic patterns in development, such as utilizing the circular economy (Foster, 2020).

1.1 Heritage

The architectural heritage of a city is a capital asset of irreplaceable spiritual, cultural, social, and economic value which reflects the unique cultural characteristic and historical features of a city at a particular time, and is the commonwealth of the urban habitat. However, in the wake of the development of cities and changes in the needs of modern human inhabitation, people have created more and more new demands regarding buildings, which has led to many historical buildings being gradually abandoned, demolished, or renovated because of a lack of functions. Heritage buildings have gradually shifted from single protection and restoration to finding new uses to meet the needs of modern society. For example, abandoned workshops have been transformed into educational facilities, exhibition halls, and art centres, and historical sites have been converted into museums or have become part of the public landscape.

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1.2 Adaptive Reuse

In 1981, the "Barra Charter" was passed in Australia, when the International Council on Monuments and sites (ICOMOS) first proposed the concept of adaptation: the transformation process minimizes the intervention in the original structure and endows the building with compatible functions or uses (Australia ICOMOS, 2013). It has developed new uses and potentials for outdated historical buildings, combined with restoration and historical protection, while at the same time providing support for the city's history, culture, and architectural value (Bullen et al., 2011). "In recent decades, adaptive reuse is not only one of the forms/means of heritage architecture but also an important feature regarding sustainable urban development. Adaptive reuse of buildings bypasses the wasteful process of demolition and reconstruction. This environmental benefit, combined with the energy savings, carbon emissions reduction, and the social and economic advantages of recycling a valued heritage building, makes reuse an essential component of sustainable development" (Department of the Environment and Heritage, 2004).

One of the most appealing aspects of transforming a heritage building is the fusion of different historical layers presented by modern components and original architectural elements. Heritage, which is transformed, follows the historical background and its embedded value, providing diversity and vitality to cities, just as modern architecture also does, and therefore increases the city's value in multiple dimensions (ICOMOS, 1987).

1.3 Urban Upgrade

The urban quality upgrade consists of the upgrade of physical space, the spiritual environment, and social network (Peng, 2017). The quality of the urban habitat, as an essential feature resulting from the physical and social environment, has been a topic of interest for academics and the general public. In the current era, when many countries and urban areas are stepping into or have already moved from the industrial age into the ecological age, humanistic ecology, more specifically in terms of economic, social, cultural as well as natural aspects, is having a vital impact on the quality of urban habitat (Yang et al., 2019). Urban rehabilitation has become one of the methods to enhance an ecosystem regarding the above-mentioned aspects of a locality and its adjacent district.

Upgrade and connectivity optimization of the urban historic treasures have been one of the keys and effective ways to promote urban rehabilitation of cities around the world with rich history. For instance, Budapest programmed a strategical cultural chain to link its heritage sites. It brings together the originally isolated impacts that the heritage sites have on their neighbourhoods. Wudadao historical district in Tianjin also provides a paradigm with its district rehabilitation (historic district management, detailed protection regulation, Push–Pull-Interaction-Service experimental project) and adaptive reuse of key buildings (Minyuan Stadium). The benefit it brings includes optimized management, social vitality enhancement, and attracting more active visitors city-wide. Rehabilitation leads to regeneration and reuses the stock of the urban built environment, employing architecture and planning. When successfully employed, regeneration and reuse create both a visible and invisible impact on the locality and its adjacent region and optimize the local humanistic ecological environment with the help of architecture, as the means/language, and the embedded value of history.

1.4 Pécs

The city of Pécs, located in Baranya county in the South of Hungary, has a population of 150 thousand within its 162 km^2 area. Nowadays, the city of Pécs is considered a cultural city with a rich history of built heritage. However, during the middle of nineteenth century, Pécs was a significant industrial centre for Hungary (Haffner, 2014). Hosting the European Capital of Culture in 2010 provided the opportunity for Pécs to boost its development in numerous fields, including the quality of urban living.

Since 2010, the number of tourists has been rising annually, while, on the other hand, the number of local inhabitants has been annually decreasing (City population, 2019). The influencing factors, in addition to economic and employment aspects, are derived from the uncompetitive urban vitality and liveability. Since 2000, Pécs has utilized numerous opportunities in the regeneration and adaptive reuse of historical and industrial built heritage. These historical roles were carried out by the implementation of adaptive reuse to create an optimal impact on local urban vitality using different approaches.

2 Case Study—Tettye Park

Tettye refers to an area to the north of the historical downtown of Pécs. Geographically, it is a valley on the Mecsek hillside overlooking the city which lies to the south of Tettye (Fig. 1). The depression in the valley is not natural, and is a result of the removal of the stones and earth which were used as building materials for the historical city in the early Christian age. Records show that the quarried material from Tettye can be found in most of the historical buildings in the city centre even today (Baronek, 2000). The area studied

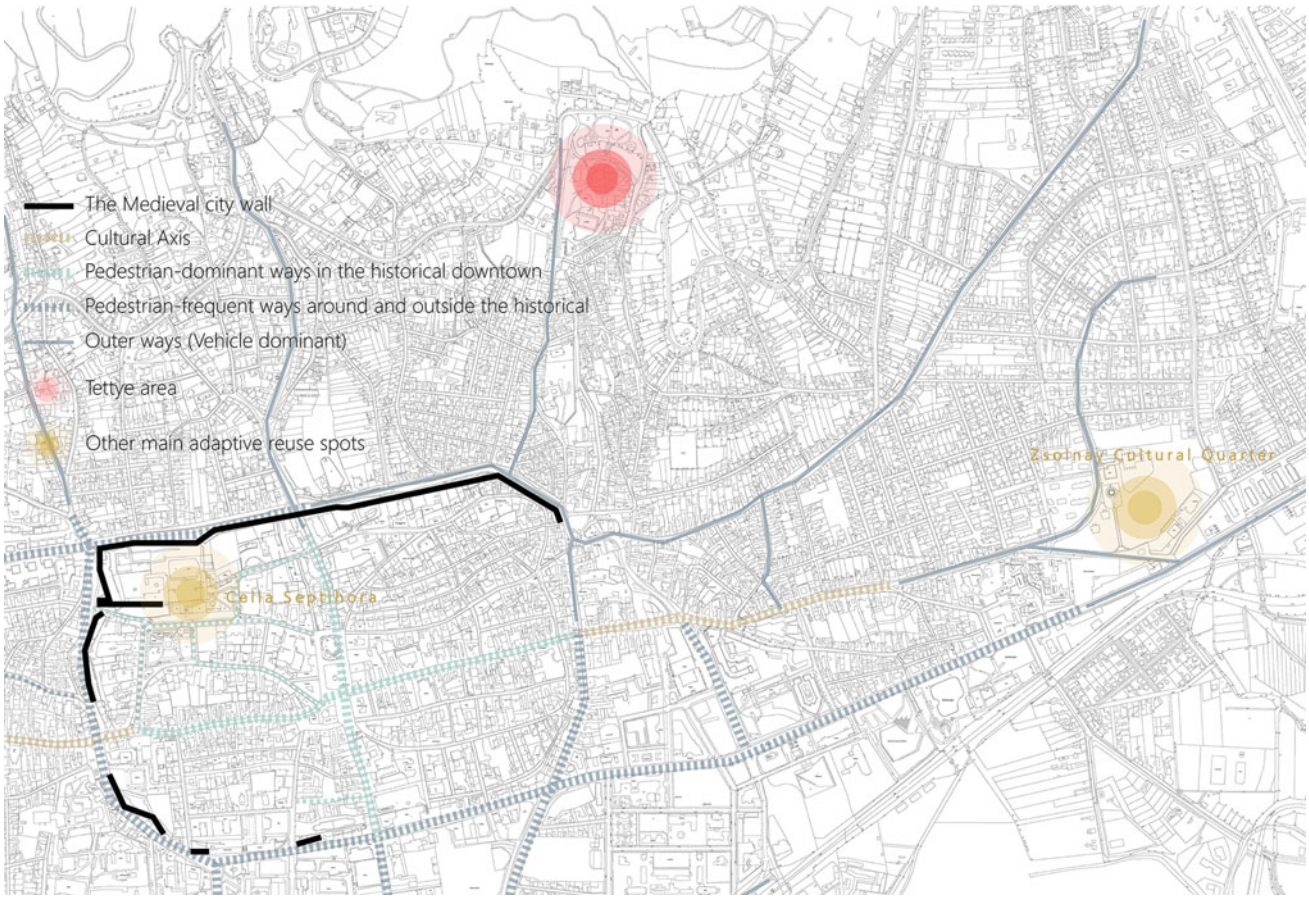

Fig. 1 The spatial relationship between Tettye historical downtown and other sites of Pécs (*Credit* Authors)

was Tettye Park consists of the previously mentioned area including the Tettye Ruins and the surroundings.

The Tettye Ruins were originally the Szatmáry Palace, built as a renaissance style summer palace of the Bishop György Szatmáry in the sixteenth century. The original building was badly damaged and by the early 1900s, only a few walls and arches could be found in their original shape. Numerous functions have been planned for the ruins including a sugar refining factory (not realized), and over the last few decades, the local authority used the ruin to host theatre performances, a function which met with success (Rosner, 2005). Janos Pinter built a botanical garden near the ruins, which attracted local inhabitants to the area and its surroundings (Rosner, 2005). Thus, the Tettye Ruins and the surrounding area enjoyed a good reputation amongst the local inhabitants and authorities for its historical and cultural value.

This appreciation and value of the Tettye Ruin area also carried over to the European Cultural Capital (Europa Kulturalis Fovaros) programme. The area of the ruins and towards the south were rehabilitated in a systematic and contemporary architectural manner by MARP in 2011. The design was presented through two dimensions: public space development of the Tettye Ruin (the Tettye Park), and the surrounding area and a walking route for a panorama of the park, the city, and cultural features nearby (Fig. 2a) (Local Government of Pécs, 2007).

The public space development involved the rehabilitation of the ruin itself with contemporary architectural structures to complement the remaining summer palace ruins, as well as creating three terraces to the south (Fig. 2b). The ruin was enhanced with several free-standing structures including a look-out tower on the boundary of the original summer palace site and the addition of benches for visitors to sit and enjoy the open space and views over the city. All the additional elements used oxidized steel as the building material to differentiate the historical elements from the new ones. The ruin site, sitting on the highest of the three terraces, is located above another terrace which has a leisure platform with seating, and further down there is another

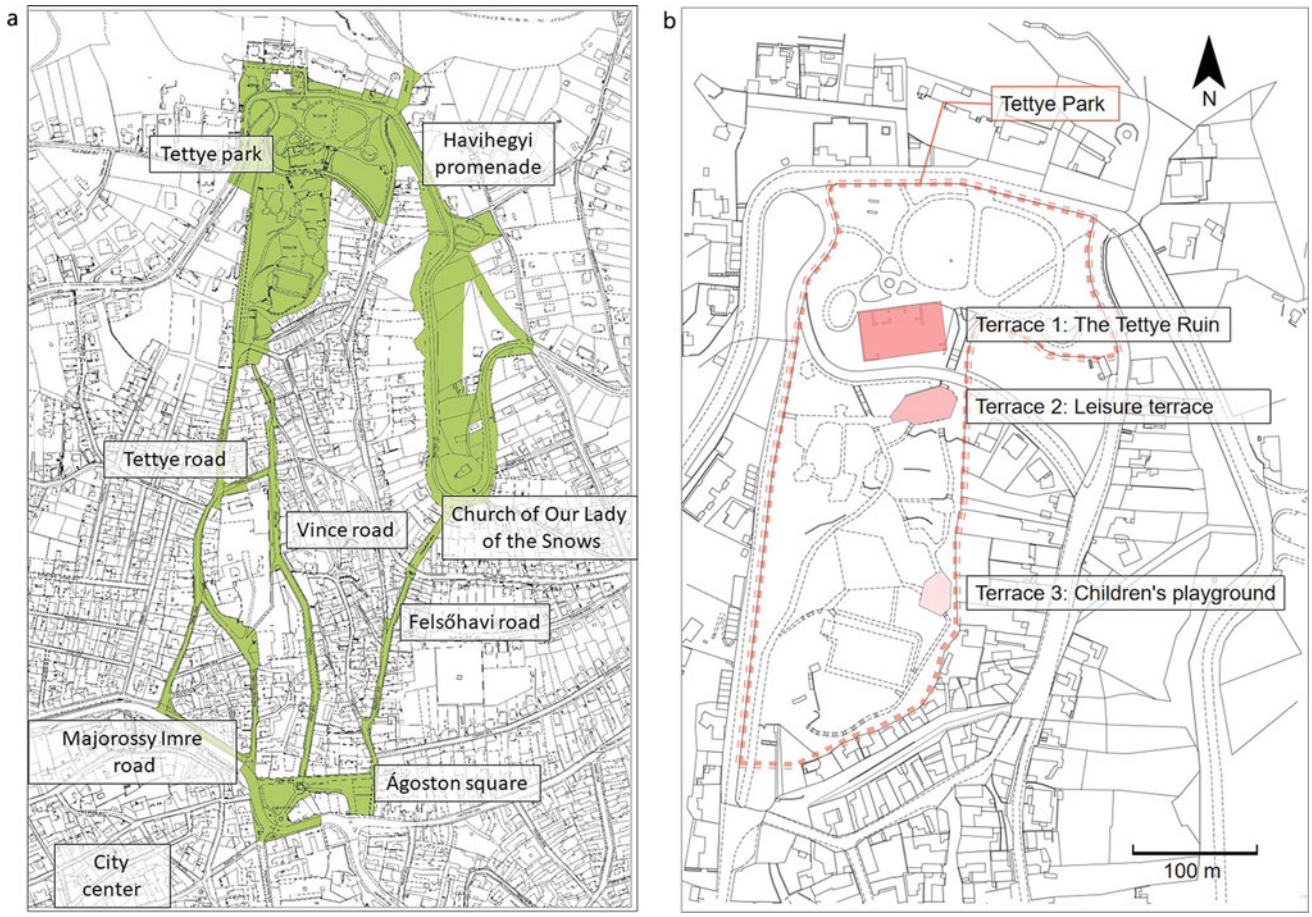

Fig. 2 **a** The name of zones and roads in the design area. **b** Tettye Park's plan. (*Credit* The bidding document)

terrace with a children's playground for children, all three terraces forming three steps towards the city centre. These terraces have become attractions for numerous groups of various age groups, people with diverse purposes and from different districts. Tettye Park was designated to enrich the communal and cultural functions, and increase the number of functions it accommodates, in contrast to its single function in the past when it was predominantly used as a transit corridor for vehicles and for parking (Local Government of Pécs, 2007).

The walking route, predominantly along Havihegy Way, is also connected to paths in the north-west corner of the historical downtown (Fig. 2a). It was designed to provide a panorama view of both the city and Tettye Park. In addition to the panorama value, the walking route integrates newly built and historical art and architectural elements (statues and sculptures, a church, well planned natural landscape features, and artistic street furniture). By incorporating efficient public space development and the walking route, the local authority had a vision to promote the connection between the city centre and the Tettye area (Local Government of Pécs, 2007).

3 Urban Connectivity, District Vitality, and Urban Habitat

This paper mainly revolves around the analysis and investigation of Tettye Park along with the upgrade of the city of Pécs. From the aspects of dimensions of inhabitation environment, district vitality, and urban connectivity, it explores the impacts of adaptive reuse of heritage buildings in urban public places. In terms of these three dimensions, the paper attempted to show the impacts of public places containing adaptive reuse of heritage on the adjacent area of the site and the belonging city.

3.1 Urban Connectivity

Over the past decades, and especially since 2000, the development of Pécs has been largely based on the EKF programme (Európa Kulturális Fővárosa, European Cultural Capital). EKF acted not only as coordinator of the programme itself but also set the goals for the city's

development. A series of rehabilitation and reconstruction projects were generated under the EKF programme at historical sites throughout Pécs (totalling around 61 sites) that were adapted to create various functions and ambiences based on their orientation (Varjú, 2008). The historical sites (ranging from the Early Christian Age to the industrial age) are inside the historical downtown (the city centre), in the buffer zone, and around the outer fringe of the urban area. After their respective adaptive reuse, they generated positive impacts on the entire city of Pécs. From the urban connectivity point of view, the impacts can be seen from two aspects: (1) the connection between the ruin itself and the surrounding area and the historical downtown became more adhesive, (2) the connection between the newly created heritage sites also became more cohesive.

The Tettye Ruin (the ruin of the summer palace) had existed in the city as a religious property (both physically and mentally) over a long period in history. In recent history, it became a popular hiking and sightseeing destination of the city due to the heritage site and the adjacent botanical garden. The stream that flows from the ruin area towards the city centre had long been utilized by traditional leather glove manufacturers in the area, and initiatives by the authorities to create a new industry in the area never eventuated. These circumstances represent the existing conditions of the Tettye Ruin area with respect to the connection with the inhabitants of Pécs. The adaptive reuse and the corresponding multi-functional area design, as previously described, oriented towards local inhabitants' daily life, as well as towards multi-age group and multi-purpose functions, enhanced the connection between the heritage site and the city centre (instead of only being seen as a hiking destination). In addition, the value of the site was especially increased for those living nearby. The planned and implemented three layers of terraces are visible from the downtown and, because of the landscape of Pécs, they are also visible from the other side of the city, which formed a visual connection on a metropolitan scale. The three terraces serve the local inhabitants as well as tourists visiting the area allowing visitors and locals to intermingle and get a view into each other's lives—each group becoming scenes in the perceived landscape. This adaptive rejuvenation project promoted cohesion, adhesion and connectivity of the city through the perception by the inhabitants of Tettye, the inhabitants of Pécs in general and tourists.

The design of the walking route connecting the Tettye Ruins area, and the downtown, as well as the renovation of the ruin itself, not only provided a connection between Tettye and the city centre but also other adaptive projects at various other heritage sites. For example, an essential part of the EKF programme was the adaptive reuse and rehabilitation projects of the Cella Septichora and Zsolnay Kulturalis Negyed (Zsolnay Cultural Quarter) that provided further daily functionality and cultural destinations in their respective area and the inhabitants of Pécs through the following two perspectives: (1) the heritage of Early Christian history and culture via contemporary architectural language, (2) adaptive reuse and revitalization of brownfield areas left from the industrial era. Pedestrian and vehicle routes, public transportation and sightseeing train routes were developed to connect these areas. The triangle formed by the three sites (Tettye Ruins, Cella Septichora, and the Zsolnay Cultural Quarter) formed a constructive foundation for the macro urban connectivity of Pécs (Fig. 1).

3.2 District Vitality

Pécs has been transformed from an industrial city to a tourist city. In addition to the long history and culture of the city, it has carried out successful heritage-building-based adaptive reuse projects to inject new vitality into the transformation of the city. For example, the Cella Septichora Visitor Centre in Pécs is the museum and reception space for the UN World Heritage site: The Pécs (Sopianae) Early Christian Cemetery (UNESCO, 2000). It provides not only the showcase of the historical culture of the city for tourists but also a venue for locals to hold various activities, for example, small-scale gatherings and wedding ceremonies. Moreover, this project attracts economic activity and enhances local people's sense of acknowledgement and identification towards their city (Bachman et al., 2010).

According to urban planner and author Charles Landry, "urban vitality is the raw power and energy with a city" (Landry, 2000). It also refers to the urban spatial structures and their influence on urban activities, which can represent the features of the urban spatial structure and a measure of the activity of residents (Aytac et al., 2016). In terms of the urban form characteristics, urban vitality embodies three factors: (1) great accessibility among neighbourhood quarters, (2) a large range of liveability regarding building construction and architectural patterns, and (3) the interspersion of appropriate and practical functions. The overall goal of the Tettye district design tender was to rehabilitate the entire Tettye area and to create a popular destination for both locals and tourists. It is comprised of the regeneration of the Tettye Park, constructing the Havihegy panoramic promenade, in other words, developing the public space and pedestrian route with urban green spaces. It helped in enhancing the connection between the city centre and the Tettye area. Becoming an exclusive public green space, the rehabilitation project of Tettye managed to connect the districts of Pécs and due to the fascinating landscape and accessibility, it has become a part of local daily life. In addition, the reuse of the remains of the Renaissance summer palace (Fig. 3) combined with the panoramic natural landscape demonstrates the unique charm and cultural landscape value of the area, which

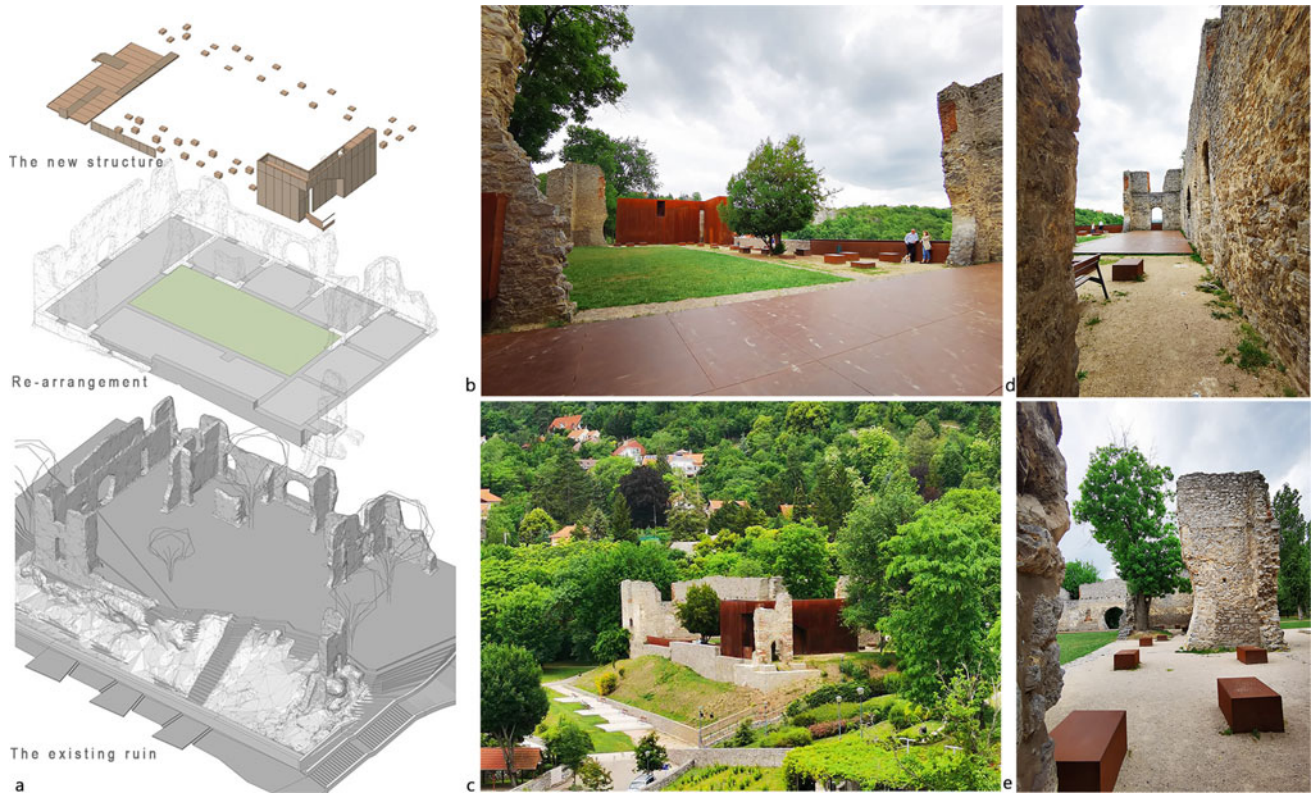

Fig. 3 **a** Graphic solution (*Credit* MARP Architects), **b** Outdoor theatre in Tettye Ruin (*Credit* Authors), **c** Overlook (*Credit* Authors), **d** The stage of outdoor theatre in Tettye Ruin (*Credit* Authors), **e** The street sitting facilities (*Credit* Authors)

in turn creates business and tourism opportunities. In addition to the clear functional separation, Tettye's triple terrace design has demonstrated another character with its multi-function. The complex functional community spaces accommodate different social groups and ages and help to enhance the extent of residents' activities.

Cella Septichora and the Zsolnay Cultural Quarter also play significant roles in stimulating the promotion of the city's vitality, bringing additional economic and educational benefits. The Cella Septichora Visitor Centre, in particular, has brought vitality to the city's tourism economy with many tourists on cruises on the Danube River taking a day trip to visit this UNESCO site. The Zsolnay area serves as a sightseeing spot due to its industrial heritage character and also houses the Faculty of Arts of the University of Pécs, therefore having an educational role. From these cases, it can be observed that the renewal of the heritage buildings in Pécs gives differing opportunities to urban residents, tourists, the education industry, and urban fabric. The reuse of heritage plays a catalytic and integrated role in the city (Versaci, 2016). It promotes the renewal of public space and the restoration of historical monuments, the development of cultural undertakings, and an improvement in the quality of the residents' living environment, balances the society and space, and also revitalizes the whole city.

3.3 Urban Habitat

Acceptable practices of urban heritage conservation can inspire inclusive and holistic approaches to urban development and lay the foundations for "fit-for-purpose" planning tools and legal frameworks (United Nations, 2017). The heritage protection and rehabilitation at the Tettye area was set to be an experimental site of Pécs. At present, it has hybrid functions and quality public space to blend multi-community groups. The built heritage provides intermedia for local citizens to identify the city's history and culture. The urban environment, the protection of built heritage, greenery, and community relationships are essential indicators regarding the living environment of the local inhabitants—the inhabitation.

The whole Tettye area has residential, religious, and locally scaled commercial functions; meanwhile, it is also filled with plenty of long-term and relatively stable private properties. As a result, it is an area of potential with stable and peaceful low-density residences. Apart from the historical downtown which is dominated by old apartments and southern Pécs which is dominated by blocks of apartments, the most dominant housing type in Tettye is detached houses, in which inhabitants with relatively higher living standards reside. In the tender document of the design of

Tettye Park and the surrounding area, besides the previously mentioned promotion of Tettye Park and the adjacent public space, social interaction, entertainment, and the promotion of culture were also set as important goals. And all of these led to positive effects after their implementation. In addition to tourists, the series of rehabilitation has also attracted inhabitants within its district, therefore facilitating multiple effects: (1) It brought the local Tettye inhabitants optimized and organized venues for activities which are suitable for multi-resident groups; (2) The tourists attracted to the district widen the social interaction of the local inhabitants; therefore the level of activities also increases; (3) The vitality of Tettye and that of the entire city complement each other, which leads to the activities related to both the commercial and cultural aspects that have become more active with broader engagement and connections.

On the other hand, the planned and implemented connection (led by the previously mentioned walking route) cements the physical and mental connection between the district's residential function and inter-communal life. Agoston Square is one of the gateways from the city centre of Pécs to the Tettye area, from where visitors are able to reach the Tettye Park on the hill to the North. Three options are provided to reach the destination Park, among which Tettye Street and Vince Street lead to the lower end of the Park, while Felsőhavi Street leads to the Church of Our Lady of the Snows where the panorama of Pécs is visible (Fig. 2a), and from there the Havi-Hegy walking route leads to the contemporarily reused Renaissance ruin of Tettye (the first terrace) (Fig. 3). The completed rehabilitation of Tettye Park has become an essential public green zone and provides both the local inhabitants and broader citizens a multi-functional venue. It covers both communal and cultural functions, holds various outdoor activities with its adaptive space, and provides meaningful entertainment and relaxation for people of every age group.

4 Conclusion/Discussion

From the dimensions of the inhabitation environment, district vitality and urban connectivity, the paper has elaborated on the essential role that the adaptive reuse of built heritage plays in urban rehabilitation and its potential in regard to the development of urban sustainability. The adaptive reuse of heritage buildings in the process of transforming from an industrial city into a cultural tourism-oriented sustainable city has become the engine for the renewal and development in the city of Pécs. The adaptive reuse of heritage buildings is the cultural, social, and economic tangible assets of the city, which reflect the city's inclusiveness and potential for cultural and economic development. This can be reflected in the following two aspects.

On the one hand, Tettye Park is used as a comprehensive urban green space in Pécs, with the reused remains of the Renaissance era holiday villa as a symbol in the Park. It is protecting historical ruins and creating a multifaceted space for the public. The Park provides a public place for outdoor activities for different age groups. Their daily life integrates the city's past culture, which makes the city's modern life and historical space interactive. It will also increase the sense of identity of inhabitants from different age groups towards the city. On the other hand, Tettye Park in connection with the Havihegy panoramic corridor presents the integration of urban time, space, and the natural environment, and is embedded in the space–time structure of urban growth. This design strategy greatly increases the visitor's interest and provides a perfect place for a better understanding of the city.

In conclusion, under the dual background of climate change and rapid technological development in the contemporary era, sustainability and low carbon would be the goals of future urban renewal (Yung et al., 2012). Cities face a more modern process of rehabilitation all over the world. Adaptive reuse of heritage buildings' ability in extending the life cycle of buildings and reducing waste and resource consumption in the demolition process is greatly appreciated. Moreover, protecting urban heritage and culture while reducing carbon emissions is a significant character in future urban rehabilitation.

References

Australia ICOMOS. (2013). *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, Australia ICOMOS, Canberra. https://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf.

Aytac, D. O., Arslan, T. V., & Durak, S. (2016). Adaptive reuse as a strategy toward urban resilience. *European Journal of Sustainable Development, 5*(4), 523–532. https://doi.org/10.14207/ejsd.2016.v5n4p523.

Bachman, Z. (2010). *BACHMAN ZOLTÁN*. Vince Books Press.

Baronek, J. (2000). *Tettye park és környéke, a park növényei [Tettye park and its surroundings, the plants of the park]*. Pécs: Baranya Megyei Önkormányzat.

Bullen, P. A., & Love, P. E. D. (2011). Adaptive reuse of heritage buildings. *Structural Survey, 29*(5), 411–421. https://doi.org/10.1108/02630801111182439.

Citypopulatn.de. (2019, Sep 23) *Pécs (Pécs, Baranya, Hungary) - Population Statistics, Charts, Map, Location, Weather and Web Information*. https://www.citypopulation.de/php/hungary-baranya.php?cityid=19415.

DEH. (2004). *Adaptive Reuse: Preserving Our Past, Building Our Future*. ACT: Department of Environment and Heritage. Commonwealth of Australia 17.

Foster, G. (2020, October). Circular economy strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts. *Resources, Conservation and Recycling,* 152(2019), 104507. https://doi.org/10.1016/j.resconrec.2019.104507.

Haffner, T. (2014). A pécsi kesztyűgyártás múltja és jövője [The past and future of glove production in Pécs]. Köztes-Európa, 2014(6), 115–123. http://acta.bibl.u-szeged.hu/id/eprint/35085.

ICOMOS. (1975), *European Charter of the Architectural Heritage-1975*. https://www.icomos.org/en/charters-and-texts/179-articles-en-francais/ressources/charters-and-standards/170-european-charter-of-the-architectural-heritage.

ICOMOS. (1987). *Charter for the conservation of historic towns and urban areas. The Washington Charter*. Retrieved 20 November 2017, from, https://www.icomos.org/charters/towns_e.pdf.

Landry, C. (2000). Urban vitality: A new source of urban competitiveness. *Archis, 12*, 8–13.

Peng, G. (2017). "Understanding Guangzhou. Focusing on quality": Paradigm of urban quality promotion in Guangzhou. *City Planning Review, A01*, 42–49.

Pécs Megyei Jogú Város Önkormányzata [Local government of the city of Pécs]. (2007). Pécs - Tettye városrész közterület megújítása [Renovation of the public area of Pécs - Tettye district]. *Pécs 2010 Menedzsment Központ Kht[Pécs2010 Management center*].

Rosner K. (2005). Tettye, természet, teatralitás: Tettyei népünnepélyek a (múlt) századfordulón [Tettye, nature, theatricality: Tettye folk festivals at the turn of the (last) century]. T Kovács, G Böhm, T Mester (Ed.), *Terek és szövegek: Újabb perspektívák a városkutatásban [Tettye, nature, theatricality: Tettye folk festivals at the turn of the (last) century]* (pp.143–153). Budapest: Kijárat.

UNESCO Region. (2000). *Europe And The North America*, WHC Nomination Documentation,853rev.

United Nations, (2017). *United Nations Conference on Housing and Sustainable Urban Development*, Habitat III. https://habitat3.org/documents-and-archive/preparatory-documents/issue-papers/

Varjú V. (2008). Barnamezős revitalizáció kultúrával [Brownfield revitalization with culture]. N Pap (Ed.). *Kultúra - területfejlesztés: Pécs - Európa Kulturális Fővárosa 2010-ben [Culture - regional development: Pécs - European Capital of Culture in 2010]* (pp. 201–213). Pécsi Tudományegyetem Földrajzi Intézet.

Versaci, A. (2016). The evolution of urban heritage concept in France, between conservation and rehabilitation programs. *Procedia—Social and Behavioral Sciences, 225*, 3–14. https://doi.org/10.1016/j.sbspro.2016.06.003.

Yang, B., Chen, P., Dong, K., & Sun, J. (2019). Formation of the national territory development planning system under the background of ecological civilization. *Urban Planning Forum, 2019*(4), 19–23.

Yung, E. H. K., & Chan, E. H. W. (2012). Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities. *Habitat International, 36*(3), 352–361. https://doi.org/10.1016/j.habitatint.2011.11.001.