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Dunaújváros and Paks: Socialist Science and Technology Cities of Hungary?

Abstract

This paper discusses the changing relationship and interconnectedness between cities, technology and knowledge in Hungary using a comparative case study analysis of Dunaújváros and Paks. Dunaújváros is a well-known so-called socialist "new city," and was the center of Hungarian steelworks. Meanwhile, Paks is still known today as the "atomic city," as it is home to the country's sole nuclear plant.

The transformation in the propagandistic representation of knowledge production can be traced by comparing the urban

PUBLICATION INFO	Studia Historiae Scientiarum	e-ISSN 2543-702X ISSN 2451-3202		DOAJ DIAMOND OPEN ACCESS

CITATION

Harlov-Csortán, Melinda; Tamáska, Máté 2025: Dunaújváros and Paks: Socialist Science and Technology Cities of Hungary? *Studia Historiae Scientiarum* 24, pp. 75–103. DOI: 10.4467/2543702XSHS.25.004.21842.

RECEIVED: 06.03.2024 ACCEPTED: 16.08.2025 PUBLISHED ONLINE: 30.09.2025	ARCHIVE POLICY OPEN POLICY FINDER	LICENSE	Crossref

WWW	https://ojs.ejournals.eu/SHS/; https://pau.krakow.pl/Studia-Historiae-Scientiarum/archiwum

structures and school buildings in Dunaújváros and Paks during the period of state socialism (1945(1947)–1989(1990)), when the focus of the state policy shifted towards welfare.

The research challenges, whether the notion of socialist science and technology cities is utilizable for these case studies and especially for the design of two school buildings located in these cities. The research identifies the role of technological innovations, Soviet urban design and local traditions in the formation of the two aforementioned cities in socialist Hungary.

The article concludes by identifying the similarities and differences between the two cities, which represent a possible continuation or adaptation of the socialist science and technology city notion conceived within but also outside the influence of the USSR.

Keywords: *socialist science and technology city, Dunaújváros, Paks, steelworks, nuclear plant, school design, propagandistic representation, welfare-oriented practice*

Dunaújváros i Paks: socjalistyczne miasta nauki i technologii na Węgrzech?

Abstrakt

Niniejszy artykuł omawia zmieniające się relacje i wzajemne powiązania między miastami, technologią i nauką na Węgrzech, wykorzystując porównawczą analizę studium przypadku Dunaújváros i Paks. Dunaújváros to znane tzw. socjalistyczne nowe miasto, centrum węgierskiego hutnictwa. Tymczasem Paks do dziś jest znane jako „miasto atomowe", ponieważ znajduje się tam jedyna w kraju elektrownia jądrowa.

Transformację propagandowego obrazu produkcji wiedzy można prześledzić, porównując struktury miejskie i budynki szkolne w Dunaújváros i Paks w okresie socjalizmu państwowego (1945(1947)–1989(1990)), kiedy główny nacisk polityki państwa przesunął się w kierunku opieki społecznej.

Badania podważają możliwość wykorzystania pojęcia socjalistycznych miast nauki i technologii w tych studiach przypadku, a zwłaszcza w projektowaniu dwóch budynków szkolnych zloka-

lizowanych w tych miastach. Badania identyfikują rolę innowacji technologicznych, radzieckiego wzornictwa urbanistycznego oraz lokalnych tradycji w kształtowaniu się dwóch wspomnianych miast w socjalistycznych Węgrzech.

Artykuł kończy się wskazaniem podobieństw i różnic między tymi dwoma miastami, które stanowią możliwą kontynuację lub adaptację socjalistycznej idei miasta nauki i technologii, stworzonej zarówno w ZSRR, jak i poza jego wpływami.

Słowa kluczowe: *socjalistyczne miasto nauki i technologii, Dunaújváros, Paks, huta, elektrownia jądrowa, projekt szkoły, reprezentacja propagandowa, opieka społeczna*

1. Introduction

After World War II, when Hungary became part of the Soviet sphere of influence in Eastern Europe, a major economic change was forced upon the country. It was transformed from an agriculture-based economy to a heavy industrial one. Numerous economic historians state that the model for this forced social change that was imposed in the Soviet Union in the 1930s, can be understood as a belated, top-down industrial revolution.[1] The development of iron production also contributed to this process.

In the mid-20th century, the Soviet Union entered the nuclear age as a world-power. The first nuclear power plant in the world was built in Obninsk, USSR in 1954. In addition to nuclear power, the countries of the Eastern bloc were encouraged to overcome their industrial setbacks[2] through space science innovations and adaptation of their technologies.[3] This transformation triggered an intense development of science and technology, as well as influenced the formation of urban structures. The newly established production centers generated the creation of new cities and scientific/educational institutions where the contemporary urban- and social goals could also be adapted and realized. This article compares and analyzes two Hungarian cities that served as symbols of the two phases – metallurgical and nuclear – in socialist industrialization between 1945 and 1990. Both Dunaújváros and Paks are located by the river Danube

[1] Wheatcroft, Davies, Cooper 1986; Rogovin 1993; Allen 1997.

[2] Mikhailova 2012; Cheremukhin et al. 2017.

[3] This never actually happened and the number of power plants is much higher in the Western part of Europe.

on the Great Hungarian Plain, south from Budapest. Dunaújváros (literally means in Hungarian New City at the Danube) is 75 km away from the Hungarian capital, while the distance between Paks and Budapest is 100 km.

The state socialist period of Hungary can be divided into two major periods: before and after the 1956 revolution.[4] After the 1956 revolution (more or less successful) steps were taken to increase the welfare system and a distinctive openness characterized the country politically and culturally within the Eastern bloc.[5] This corresponded also to the changing foci of industrialization. In the first period, emphasis had been placed on iron-related industries; in the second, on energy production.[6] The first period is exemplified by Dunaújváros, the "city of ironworks" and the best example of Socialist Realist architecture in Hungary. Dunaújváros, then Sztálinváros (Stalin City), was established next to a small village of circa 3000 inhabitants. At the peak of production in the 1980s, approximately 60 000 people lived in the settlement. The established urban structure partly follows the example of Socialist Realist architecture, but it also continues local traditions. For example, the building of the technical school uses the late Baroque – early Classicism stylistic elements that were used in noble palaces in the Hungarian countryside.

In the second phase of socialist industrialization in Hungary, energy production was the major economic goal, which is exemplified in this article by Paks, where in the 1970s, Hungary's only nuclear power plant was established. In Paks, a new city was founded next to the original downtown, which was called "nuclear city". The population of Paks increased from less than 14 000 to circa 20 000 inhabitants due to the "enlargement". Pure functionalism characterized the architectural style in the new city but blocks of flats were also decorated with ornaments that were similar to those used in vernacular architecture. Together with some public buildings (such as the cultural centre, the gallery, an elementary school and the church building designed by Imre Makovecz), one of the

[4] Kovács, Horváth, Csikós 2023.

[5] Valuch 2021.

[6] It has to be emphasized that these two periods are highlighted especially for the purposes of this comparison. It should be noted that there were important phases in between the metallurgical and nuclear periods that also had a significant impact on urban development, such as the importance of the chemical industry in Tiszaújváros discussed in Gille 2007.

first Hungarian Postmodern urban structures began to form there.[7] This happened because the State did not influence the architectural and urban style of the city as much as it had done during the first decade of construction in Dunaújváros. The immense number of prefabricated concrete block of flats in Paks did not serve as ideological symbolism, but purely addressed the accommodation needs of the increasing local population.[8] However, the local vocational education building did serve propagandistic aims, even if it did not have typical political symbols (e.g. a red star at the entrance). The huge, modern sport fields suggested that the ideological system of the country was capable of improvement and matching contemporary developments elsewhere.

The aim of the paper is to investigate how far and in what ways Dunaújváros and Paks can be understood as examples of socialist science and technology cities. This includes identifying the power structures and top-down intentions represented within the architecture and urban design of the education buildings in these cities during the socialist ideology-driven period in Hungary. The analysis starts with an introduction of the Soviet socialist urban scene and an overview of socialist urban typologies. The locations of production and urban morphologies are examined in order to present the architecture-infrastructure-environment system of socialist science and technology cities. The second part of the investigation focuses on the aforementioned Hungarian case studies. In these analyses, it was not possible to focus on the entire architectural landscape within the chosen cities. Instead, the local vocational educational buildings where new science and technology were taught are the focus of this study. This contribution also illustrates the changes in and different understandings of vocational education throughout the researched period: 1945–1990.

2. Soviet socialist urban features

Throughout Europe, in the mid-20th century the preferred concept was the well-structured Modernist city. In opposition to the allegedly chaotically developed capitalist cities of the 19th century, where spontaneous market interests defined the changes. Modernist urban planners named logic and rationality as the key forming concepts. Both in Eastern and Western

[7] Szőnyeg-Szegvári 2020.
[8] Molnár 2005.

Europe, the defining urban-planning concepts were the separation of functions (accommodation, production and recreation) and the harmonization of the hierarchically ordered transport systems (from the multi-lined roads to the pedestrian zones).[9]

Such Modernist urban-planning notions were well-received during the interwar period in the Soviet Union, where the new city concept went hand in hand with social revitalization programs of that time. However, these Soviet Avantgarde urban-planning projects were usually not realized due to, among other factors, lack of money, technological knowledge and political will.[10] Accordingly, in the 1930s and 1940s, a more traditional, well-ordered "empirical" city model started to spread. Its style was Socialist Realism meaning that it expressed realism by accepting that contemporary technological innovation in the construction industry could not actually be realized in that context. The new skyscrapers planned to be made of reinforced concrete and glass could not be constructed in Soviet-Russian settlements despite the input of extensive human labor in construction projects. The strong ideological affiliation (socialist) and the acceptance of circumstances (realism) led to the construction of socialist cityscapes with their wide roads, hand-built towers and triumphal gates.[11]

Industrialization and urbanization went hand in hand in the second part of the 20th century as well, especially in the 1960s.[12] However, most of the Soviet urbanization projects aimed to create and maintain middle-sized towns both for controlling the public and due to mass transportation challenges.[13] Private car ownership was introduced only in the 1970s, but even then, in a highly modest way in comparison to Western countries.[14] The speed of urbanization was intense at that time in connection with industrial, mining and military regions.[15] New cities were developed without paying much attention to the need of natural and economic resources.[16] As researchers of Soviet and post-Soviet Russia, Becker, Mendelsohn and Benderskaya emphasize: "the Soviet focus on military and

[9] Hall 1996.
[10] Mumford 2009.
[11] Major 1948; Bullitt 1976, pp. 53–76.
[12] Nefedova, Treivish 2003.
[13] Osborn 1963.
[14] White 1979.
[15] Lappo 2005, p. 221.
[16] Becker, Mendelsohn and Benderskaya 2012.

industrial production rather than providing consumer goods and services may have made the contrast between marginal and dominant cities somewhat more striking than elsewhere."[17]

Soviet cities tended to locate the administrative units, public spaces and residents of those employed in administration in central areas. These areas were followed by industrial units (such as factories), then housing units that were usually multi-level and service units (like schools and clinics) on the relative outskirts of the city.[18] Such Soviet urban feature that residential areas were located next to or in industrial zones meant that cities rarely had suburban areas or agglomerations.[19] Interestingly, cities today tend to follow almost the opposite structure, where skyscrapers and high-density buildings characterize the centers rather than the peripheries of the settlements.[20]

Soviet cities were created by central planning projects following and representing the central ideology of that time.[21] For instance, housing space units were regulated centrally, which resulted in spacious community areas and limited private spaces. Even though the latter were increased throughout the decades (from the 1960s onward), they remained small in size and poor in quality.[22] In addition, because the land and the property were state-owned or could be requisitioned by the state at any time, people were less likely to spend money on their improvement.[23] Similarly, structures and floor plans of residential complexes and service units (such as shops and cinemas) were also centrally planned and provided, which led to uniformity. On the one hand, this prevented inequality, but on the other hand, it neglected local features and needs.

2.1. Socialist city typology and the socialist science and technology city

Socialist cities are difficult to define because of the changing borders within the Soviet Union as well as the various definitions and categories

[17] *Ibid.*, p. 20.
[18] Bertaud, Renaud 1997.
[19] Maloyan 2007, pp. 67–81.
[20] Bertaud 2006.
[21] Vladimirov, Naimark 2002.
[22] Herman 1971.
[23] Zhimbiev 2000.

for each type of settlement.[24] Literature on socialist cityscapes defines different categories based on the main features of certain towns. Numerous urban theoretical approaches are also connected to socialist cityscape descriptions. Certainly, many of these categories are comparable to Western urban typologies like Kate Brown's comparative investigation of cities built next to nuclear fuel plants in the US (Richland, Washington) and the USSR (Ozersk).[25]

Socialist urban development and industrial activities were strongly interrelated. Accordingly, industrial towns formed one of the key categories. Based on a wide range of literature, local production units could be characterized by specialized and complementary features.[26] The necessity of education and training facilities on spot was another typical characteristic. As they focused on knowledge and practice connected to local production, these facilities ensured the provision of well-trained human resources.[27]

Speaking of industrial districts or clusters, Allen J. Scott emphasizes that the social and economic features defined many further characteristics of these areas, namely the structure and the functional units of a given industrial area. He points out that the connection of production units, workers and related functions could increase the size, variety and effectiveness of the realized local economy and the accomplished development within that field.[28] In contrast, socialist economy and production are often criticized for their lack of improvement or inability to change. The unchangeability of production process also led to consistency of the urban structure at these locations.[29] The lack of improvement can be partly explained by the fact that there was hardly any possibility for socialist professionals to become familiar with other production techniques. Nevertheless, they were assigned to be internationally competitive without having sufficient information about the competitors. Hence, many industrial cities during the researched period had scientific research institutions or departments within the industrial production unit that defined the social complexity of the settlements as well.[30]

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[24] Pivovarov 2003.
[25] Brown 2015.
[26] Braunerhjelm, Feldman 2007.
[27] Oqubay, Lin 2020.
[28] Scott 2022.
[29] Kaukonen 1994.
[30] Karlsson 2010.

There are investigations and categorizations of socialist cities that focus on the given industrial field around which the urban – social – economic – functional unit was formed. For example "plutonium cities" can be characterized, especially in the Cold War period, by intense secrecy, homogenization of the workers and even less attention paid to the health and well-being of the inhabitants than in other "specialized Soviet cities."[31] As the Cold War period can also be characterized by military competition, numerous "new" socialist cities were built around or as a result of these military-related activities, such as aerospace or chemistry.[32] These were also almost completely or fully closed cities that were not represented on maps and flows of incoming and outgoing visitors were carefully monitored. Unlike most of the industrial settlements, these cities were characterized by improvement and competitive forces.

Innovation took place mainly in the military-industrial field to support the rising superpower role of the USSR and became a key tool in international competition. It also led to a new urban development: socialist science and technology cities. The idea of a science and technology city originated in the interwar period and was also realized outside the USSR.[33] The first science and technology cities in the 1930s were part of the Soviet Gulag labor camp system. There, scientists who had to solve theoretical or technological issues, were effectively prisoners.[34]

This changed in the 1950s for political and historical reasons, and also because more complex and technologically intensive projects had to be undertaken. These projects required a suitable manufacturing setting and equipment, as well as the necessary human resources. This resulted in a combination of technology, scientific research institutes, labs and production units. Besides the spatial connection emphasized by Oh,[35] the rate of scientific innovations and development is another main characteristic of this urban typology. Such concentrated technological innovation and industrial production are key elements of Castells and Hall's classical definition of a science city.[36] This understanding also alludes to the social structure of these settlements with their significant ratio of more educated

[31] Brown 2015, p. 280.
[32] Schweiger, Stepanov, Zacchia 2022.
[33] Channell 2017, pp. 90–127.
[34] Siddiqi 2015.
[35] Oh 1999.
[36] Castells, Hall 1994.

inhabitants. New developments constantly challenged the innovative nature of these socialist science and technology cities,[37] that were supposedly prevented by creating efficient urban amenities and facilities.[38]

Schweiger, Stepanov, Zacchia express that "[w]ith the objective of co-locating scientific research centres, training institutes and manufacturing facilities, the Soviet government established about two-thirds of science cities by 'repurposing' existing settlements, while the rest were built from scratch."[39] Even though relative freedom and better living conditions were provided in these socialist science and technology cities, constant surveillance of the totalitarian regime existed at the same time.[40] Accordingly, these urban structures not only represented the connection of science and technology, but the governing power and its ideology as well.

3. Hungarian case studies

Characteristics of the new political system (dictatorship) in Hungary after World War II influenced urban development and contemporary architectural style as well. Like in the USSR, where agriculturally prosperous areas experienced belated urbanization, the local geographical and economic characteristics and aims also influenced urbanization.[41] It was hoped that Hungarian farmers could be quickly and effectively transformed into socialist workers by becoming miners.[42] Such newly initiated mining activities were also responsible for triggering new urban structures.

Numerous Hungarian architects were aware of the Soviet-type architectural style because of their foreign education in Moscow in the 1930s or because of their political and ideological stance. For instance, Imre Perényi and Tibor Weiner, who were the main architects of Dunaújváros studied in Moscow[43] and Máté Major, the key ideologist of the new architectural style in Hungary, had been an active member of the communist movement before 1945.[44] Dunaújváros, then called Sztálinváros [Stalin City]

[37] Dearing 1995.
[38] Pratt 1997.
[39] Schweiger, Stepanov, Zacchia 2022, p. 328.
[40] Shlapentokh 1990.
[41] Harris 1971.
[42] Germuska 2013.
[43] Weiner 1951.
[44] Petróczy, Saád 2022.

was inaugurated as the most outstanding and complex example of Socialist Realism in Hungary.[45] The Socialist Realist style was adapted in Hungary along the political influence, even though most architects called themselves Modernists.[46] For instance, Weiner's master plan of Sztálinváros (as it was then) contained many of the hallmarks of CIAM (International Congresses of Modern Architecture) Modernist city planning, including the buildings of the main square.[47]

After the death of Stalin, both Soviet and Hungarian urbanism changed radically. Architects not only turned away, but even rejected the previously popular Socialist Realism. Its characteristic style with decorations was replaced by technocratic functionality e.g. with good transportation connections. The notable symbol of this industrialized, functional architecture was the Khrushchyovka, cheap, uniformized prefabricated concrete block of flats and the entire living districts consisting of these buildings.[48]

Even though such a change in Hungary was related to the political events in the USSR, contemporary architects saw it as a return to the West. Western architectural journals became popular again and an increasing number of case studies from Western Europe were introduced in the Hungarian specified media.[49] Accordingly, the new Hungarian urban spaces from the late 1960s and mid-1970s expressed a unique hybridity. They displayed commonalities with their Western counterparts, but the adaptation using rather poor materials and simple methodologies also connected them to the Soviet bloc. Exemplifying such hybridity, the city of Paks employed different, almost opposing architectural solutions resulting in a rather chaotic cityscape despite the fact that it was designed by the best architects of that time.

3.1. Dunaújváros and its vocational educational building

Dunaújváros, as a pilot project of industrialization was supposed to exemplify the preferences of socialist nation-building. Its architectural history is strongly related to the Soviet military economic system. Planning and realization happened simultaneously without taking into account the human and financial requirements of the project. An important aspect of

[45] Pittaway 2005.
[46] Keller 2020.
[47] Kuslits, Horváth 2013.
[48] Musil 1980.
[49] Simon 2013.

choosing its location was the country's extensive economic relations, especially the Eastern orientation due to the raw materials transported to the steelworks on the river Danube.[50]

Even though Dunaújváros was new as a city,[51] it was not a new urban model rather the adaptation of an already existing (and idealized) industrial city plan.[52] The entire city was built to serve the needs of the steelworks. Therefore, it consisted of the port, the steelworks, the accommodation district of the workers and "the center." The central area consisted of the main square with the party headquarters and other propagandistic service units, such as the cinema. It was also supposed to target the entire country and the theoretical and ideological knowledge production and management operated there.[53]

Pure power expressed by the giant machines of the steelworks represented a propagandistic message.[54] This "power grab" was reflected in the urban structure as well as in the adaptation of the town's architectural heritage, which was rooted in Classicism and became the basis of a new urban style.[55] Even though the buildings in general were not tall, they were impressive. While they were mainly functional, especially the blocks of flats, they also formed expressive cityscapes.[56] A vivid example was the water tower at the end of the May 1st housing estate, which appeared as the vanishing point of a line of prefabricated concrete blocks of flats (Fig. 1).

Such a setting is not just picturesque it also places emphasis on the "modern practicality" of the water tower. Other examples or plans were even simpler. For instance, a tower of the Party headquarters that was never built was meant to replace the function and symbolism of church towers in traditional cities. Similarly, the tall tower of the port characterized

[50] It is important to note that originally, the new steel city was meant to be established in the border city, Mohács. It had to be modified and the whole project was relocated to the center of the country due to the challenged relationship with Yugoslavia.

[51] The population number increased significantly due to the industrialization of the city. It hosted fifteen times more people by the 1980s than at the beginning of state socialism (almost 60 000 inhabitants). More information about the population increase can be found on the Central Statistics Office website: https://www.ksh.hu/nepszamlalas/tablak_teruleti_07 (accessed on 12 July, 2022).

[52] Kissfazekas 2015.

[53] Laszlo-Herbert 2016.

[54] Kiscsatári 2017.

[55] Jász 2018.

[56] Kuslits, Horváth 2013.

by decorated colonnades, which – despite its Hungarian-style ornaments – resembled the classic ports by the Black Sea or the river Volga (Fig. 2).[57]

Fig. 1. Water tower as a closing landmark at the end of an avenue along which the May 1st housing estate was constructed in Dunaújváros.
Source: UVATERV, 1955. Public Domain.
URL: https://fortepan.hu/en/photos/?id=91079 (accessed on: 12 July, 2022).

Fig. 2. The main building of the new port was a connecting point between Dunaújváros and the USSR in architectural terms too.
Source: UVATERV, 1954. Public Domain.
URL: https://fortepan.hu/hu/photos/?id=91635 (accessed on: 12 July, 2022).

[57] Matussné Lendvai 2005.

Within this ideologically influenced cityscape, the high school level technical institute was established in 1952, where education and training of future metal-workers were envisaged.[58] Its planning and construction project was led by József Malomsoky and the inner design by Pál Mináry, members of the centralized state-led construction company called VÁTI (Scientific and Planning Institute of Urban Planning).[59] It is quite telling that even though the training was aligned with the needs of the steelworks during the planning and realization phase of the city, local education was only provided for skilled labor. More advanced, engineering professional schools were located in other settlements.

The school building is situated next to the factory with only a protective wall lying between the two. The entire neighborhood is named after the school (Technical institute [Technikum] quarter) that also served as its architectural central point.[60] The school was supposed to have its own square with a dormitory and a vocational training center constructed around it. Such an educational district was never realized but the school building itself, because of its impressive palace-like style, played a striking role within the cityscape.

The central, outstanding, half-rounded avant-corps creates a ceremonial effect. This is the location of the central hall and it is decorated accordingly.[61] The rest of the building has no innovative features, however. No contemporary experimental details (e.g. alternative lighting, new classroom arrangement[62]) can be identified. The order of the classrooms is aligned with the traditional school building model and reminds the viewer of a business center (Fig. 3).

The building is like a miniature model of all the historical, political and architectural features that characterize the establishment of the entire city in the 1950s. While it is a very representative, simple, propagandistic piece of architecture, it does not express high-technology or innovation. It represents power much more than knowledge. The school was an extension of the steel factory, where new generations of metal-workers for the factory were trained. However, neither the school building, nor the institution was

[58] Barka, Fehérvári, Prakfalvi 2007.

[59] Csáki, Füle 1974.

[60] The school building has retained this central point function even today.

[61] Due to the quality of the raw materials used during the construction, this building still appears to be elegant.

[62] Kassai et al. 2021.

Fig. 3. The main building of the vocational educational institute in Dunaújváros.
Source: Sándor Gallai's photo, 1955. Public Domain.
URL: https://fortepan.hu/en/photos/?id=114715 (accessed on: 12 July, 2022).

able to attract specialized engineering knowledge production to the city. Change happened only after institutional transformation when a branch of a specialized university was based there. The educational institute was integrated and transformed into a branch of the Heavy Industrial University of the country in 1969.[63]

Based on these facts, one could ask whether Dunaújváros can be considered as a socialist science and technology city.[64] If we see it as a systematically created complex production base by the state system, then the answer would be yes. However, steel production cannot be considered as high technology, even at that time. It was rather the legacy of the 19th century, only existing as pure power represented by a sector of the contemporary economy producing raw materials. Based on Anttioriko's characteristics of genuine science cities, where "little or no high-tech industrial activities and manufacturing"[65] is one feature, steel production would qualify for calling Dunaújváros a science city. However, Anttioriko also refers to "scientific

[63] The specialized university was established in 1949 in Miskolc and renamed Miskolc University in 1990. Since 2000, the vocational educational institute in Dunaújváros has operated as an independent university focusing on economic and engineering studies. The main building of this new university has retained the original educational architecture of the city from 1952.

[64] Horváth 2005.

[65] Anttiroiko 2004, p. 398.

activities, basic research, and universities, designed according to campus model"[66] as a defining requirement, but this was not realized during the construction of the Hungarian city. Originally, a high school level technical institute was inaugurated in the newly built socialist industrial city. In this sense, it was not initially the intention that Dunaújváros should become a socialist science and technology city as the practiced science and technology were not connected to development and adaptation of innovations.[67]

3.2. Paks and its vocational educational building

The decision to build a nuclear power plant next to Paks was made in 1968, but the actual construction started only in 1971. This development project happened during the transformation from ideologically driven times to a more technological and well-being-focused race between East and West. The relative freedom and comfort, in comparison to life in the 1950s, are evident in the architecture of Paks.[68] For instance, the architectural design of the service units in the residential areas expressed a kind of welfare.[69]

Paks was not a new town. It was expanded with the development of the nuclear power plant and the related urban units. The latter consisted of prefabricated concrete blocks of flats which were built from 1973, as well as detached houses. This did not mean that Paks could not be referred to as a socialist science and technology city, as the size and the single urban unit feature are not a core-requirement.[70] Just like in Akademgorodok, the post-Stalinist showcase city of Soviet science improvement and of a "new way of living" in the Khrushchev era,[71] where green locations were highly cherished; the extensive green spaces were one of the key advantages of this new town in Paks.[72] Bugaev, Piskunov and Rakov argue for direct correlation between the significance of greenery and the architecture style of that period: "the rejection of the use of decorative elements in housing construction in the post-Stalin epoch stimulated architects to pay more

[66] *Ibid.*
[67] Vámossy 2016.
[68] Bencze 1995.
[69] These services in the prefabricated concrete blocks of flats have been mainly closed by now.
[70] Bugliarello 1999.
[71] Smith 2010.
[72] Imogen, Wade 2022, p. 214.

attention to the greening of cities."[73] However, this was not true for the original inhabitants of ("old") Paks, who had already lived in detached family houses with private gardens.

Similar to Dunaújváros, the location was chosen systematically. On one hand, the closeness of the river Danube was important to ensure the necessary cooling water for production. On the other hand, security measures were taken into account. The power plant was supposed to be located far from the border region for military reasons and in a wind tunnel that had a small population. In the case of an accident, the radioactive air would not harm the population. These considerations are correlated to Schweiger and her colleagues' findings regarding the creation of socialist science and technology cities, namely:

> [t]he establishment of science cities and the criteria for selecting their location were largely guided by political and military or strategic considerations (Schweiger, Stepanov, Zacchia 2022, p. 322).

The old town of Paks consists of a traditional main street and village-like sideroads. The "nuclear city" is located next to this old town together with the power plant, which can be found a little bit further away, but still within viewing range.[74] The original small town served all the needs and supplies of the workers during the entire construction project, which lasted almost a decade.[75] This was an improvement in comparison to Dunaújváros, where there had been very few service units available during its construction.[76] The urban structure of the "new town" was not especially innovative, but it was harmonized with the natural surroundings. At the center of this new town, on a hillside, was the main square. This included the service units for the nearby four-floored, prefabricated concrete blocks of flats together with the cultural center. This structure was

[73] Bugaev, Piskunov, Rakov 2021, p. 289.

[74] Bencze 2001, pp. 157–170.

[75] Unlike Dunaújváros in 1950, Paks had a reasonable local population (approximately 15 000 people) at the beginning of the construction project. This number did not increase as significantly as in Dunaújváros. At its population peak, around 20 000 people lived in Paks. More information about the population increase can be found on the Central Statistics Office website: https://www.ksh.hu/nepszamlalas/tablak_teruleti_17 (accessed on 12 July, 2022).

[76] A small village called Dunapentele existed nearby, but its infrastructure was not suitable to serve the needs of the construction project.

characteristic of all of the residential areas that consisted of prefabricated concrete blocks of flats in Hungary at that time.

Even though the "soul of the city" was the power plant, it did not become visible or significant, at least its production did not. The steelworks had often been depicted in numerous propagandistic photos with pipes, a furnace and molten metal plates. In contrast, the power plant was visualized only showing deep holes in the ground during construction or a neutral setting of the control room in the laboratory.[77] The general public could not understand the production there. Nuclear research was generally available only for the few, even though it defined everyday life, as knowledge about complex and theoretical physics would have been necessary to comprehend it.

Both Paks and Dunaújváros exemplify national construction projects. Paks was realized in a much more consolidated way in the 1960s and 1970s than the constructions of the 1950s. Besides the different historical periods, the adopted technology and its relation to the socialist ideology were quite different. With the monumental architectural project in Dunaújváros, the new regime aimed to create a self-statement. At the time of the constructions in Paks, the political system did not have to express or prove anything via architecture or urban design to ensure its success. Accordingly, the architectural space in Paks was practical, but it did not have any extra value.[78] The well-known, prototypical residential area consisting of prefabricated concrete blocks of flats was not innovative or political. It only served to accommodate the increasing number of inhabitants.

Nevertheless, Paks plays a role in Hungarian and Eastern European architectural history due to the decorations on the sidewalls of the prefabricated concrete block of flats (Fig. 4).

Young architects designed huge tulip-like motifs on these surfaces that were unusual, but still well-known to the public, because they resembled typical organic forms of Hungarian folk art.[79] Publications about these motifs (the so-called "tulip-debate") formulated the first open battle between Modernist and the Postmodernist architects, who preferred regional and organic theories. Paks even became the center of this latter group, and

[77] Haba 2012.

[78] Molnár 2005.

[79] The leading member of the design team, called Pécsi Csoport [Group from Pécs] was the young György Csete, a defining representative of Hungarian Organic architecture. Simon 2006.

Fig. 4. Tulip-like motifs on the wall of a prefabricated concrete block of flats in Paks as a revolutionary design against the monotony of these buildings by young architects. Source: Máté Tamáska's photo, 2017. CC BY 4.0.

their leader, Imre Makovecz was appointed chief-architect of the city in 1986.[80] It is worth mentioning that he openly criticized the socialist regime. While Dunaújváros had been planned and built by politically loyal professionals, Paks was established by dissenters.

The engineering vocational high school, college and sports hall in Paks were built in 1986 and designed by Péter Várnagy (Fig. 5).[81] It served the same aim as the high school level technical institute in Dunaújváros that had been built almost 3 decades earlier. Both were planned to provide the knowledge basis for local industrial production. However, in the case of Paks, since its inauguration, the local education system provided possibilities to earn a university degree as the Budapest Technical University outsourced one of its programs there. Moreover, this complex education system in Paks was not directly state-owned, but was established and funded by the nuclear plant.

The school building is a typical piece of Postmodern architecture that playfully adapts historical forms. Thus, it stands in clear opposition to the uniformity of the prefabricated concrete block of houses inspired by late Modernity. Such differentiation is also marked by its location within the

[80] Gerle 2005; Beregnyei 2015.

[81] Today the institute is called Energetics Technical Institute and College Paks. Gettó 1992.

Fig. 5. The vocational education building in Paks, an outstanding example of Postmodern architecture in the country. It was built in 1986 and planned by Várnagy.
Source: Máté Tamáska's photo, 2017. CC BY 4.0.

urban space. The school stands in between the old town and the newly built town along the main road. There are numerous structural, formal and decorative segments of the building that stylistically resemble the turn of the 19th and 20th century. Such examples are the three-floored corner balcony, the cubic surface, or the pediment in front of the main entrance. Such historically inspired forms are incomparable with the monumentality of Socialist Realism. They are not monumental, instead they are almost playful. The adapted materials are insignificantly light and their light-yellow color further emphasizes their delightfully "anti-monumental" character.

These architectural characteristics were also aligned with the pedagogical reforms in the second part of the 20th century. School became more of a meeting place for youth than the location of education that would lead to a far, unknown future.[82] The sport fields and the sport hall next to the

[82] Such a delightful effect is partly created by the internal design and plan by Ágnes Uherkovich.

school building further emphasized this relaxed atmosphere that focused on the present and could be compared to British college-like institutions.

One of the best-known examples of Hungarian Organic architectural style, the Holy Spirit Church, was built between 1987–1988 in Paks and designed by Imre Makovecz (Fig. 6).

Fig. 6. Holy Spirit Church, the most famous building in Paks, symbol of Hungarian Organic architecture. It was built in 1987–1988 and planned by Imre Makovecz. Source: Máté Tamáska's photo, 2017. CC BY 4.0.

However, such architectural transformation (based on Hungarian Organic architecture style) was mainly realized on paper and through debates, as at the end of the 1980s, Hungary experienced economic crises and the political and economic system changes had already started. Nevertheless, in Paks, some significant pieces of Organic and Postmodern architecture were built. One example of that is the local vocational educational building.

4. Conclusion

This paper aimed to compare Dunaújváros and Paks from the perspective of their expressed message regarding city – technology – knowledge. The comparison examined the connection between education and production

in these two iconic Hungarian cities as possible examples of socialist science and technology cities (dedicated to metallurgy and nuclear energy). The "genuine Soviet science cities" were isolated and their innovations and developments did not greatly influence their immediate regional surroundings.[83] In those cities, researchers were supposed to create something outstanding with which the state could become successful in international competition during the Cold War period.[84]

The Hungarian examples followed a tested construction and urban model. The example of Akademgorodok can be compared to Paks and Dunaújváros. These Hungarian state socialist cities were promoted extensively to the general public, but they were also consciously planned in a top-down manner as show-case examples of a successful regime. The message of Dunaújváros (from the 1950s) was supposed to improve public opinion about and trust in a newly adapted political and ideological system. On the other hand, Paks was the result of a mega-project realized during the second part of Hungarian state socialism that is often called "fridge-" or "goulash" communism due to the relative prosperity and freedom of that time.

Dunaújváros can be seen as a modernized version of the typical industrial cities of the 19th century, where necessary but not very advanced knowledge was produced. It was not, however, adequate for competing in the international industrial arena. The aspects that can be compared to socialist science and technology cities were the quick mobilization and transformation of the agricultural social units and the heroic construction projects that included numerous improvized features. The architectural image of Dunaújváros expressed propagandistic ceremonialism and victorious revolution. Alike the local school building that illustrates the regeneration of skilled labor force as the educational aim.

On the other hand, Paks was built during the more established state socialist period of the country and it reflects that. The location of the nuclear city was practical as it was built next to an already existing settlement, therefore basic infrastructure did not need to be constructed. The nuclear plant was a high-tech product, which was beyond the understanding of the general public. Its location outside the city due to security reasons and appearance (schematic box-like formats) did not provide any visible

[83] Anttiroiko 2004.
[84] Josephson 1997.

insights into its function. The planning of the new "nuclear city" unit followed the general process of its time with conventional arrangements. However, the new aims of the Postmodern era can also be identified in the handful of Organic style buildings or architectural designs that contain historical allusions or playful (non-ceremonial) decorations. Such an exception was the vocational educational building in Paks, which from its beginning hosted higher education and provided university-level diplomas for its students.

Despite the significant changes and differences, both cities symbolized a social image of engineering knowledge, industrial production units (steelworks and a nuclear plant) and specialized, vocational educational institutions. Both construction projects were state-led and therefore similar to how Castells and Hall define such science cities:

> [b]y establishing a new center of science under its direct control, the State declares its capacity to master modernity and power simultaneously, breaking away from the old molds to shape the future through the instruments of science (Castells, Hall 1994, p. 83.).

However, in accordance with previous Hungarian studies,[85] we reject the hypothesis that there were new settlements in Hungary where high-tech (such as nuclear or space science) research and innovation were realized (partly in secret) in order to ensure the competitiveness of the entire Eastern bloc.[86] Such Hungarian institutes were located mainly in or next to the capital and connected to the academic and higher education fields. Hungarian settlements that were similar to socialist science and technology cities were mainly related to raw material production or (heavy) industry, such as in Miskolc or Veszprém. Similarly, the new or semi-new settlements of Dunaújváros and Paks fell under the same category. These cities symbolized applied sciences and not theoretical ones. They were adaptations of a tested model in the Eastern bloc.

[85] Szelényi 1996; Prakfalvi, Hajdú 1996.

[86] Even though the reason for that has not yet fully been researched, it can be assumed that among others, the location of Hungary (next to the Iron Curtain), the language barrier and the USSR leadership's general distrustfulness of Hungary due to its position in World War II and to the 1956 revolution played a role in not establishing high-tech research centers in Hungary.

The architectural variations between the two settlements are based only partly on the different time periods and architectural styles. They are also the result of different ideological aims. Dunaújváros represented a revolution that triumphed over Western ideology, but Paks already aimed to succeed Western production levels by adapting Soviet high-tech. One cannot forget that after the Chernobyl disaster of 1986, the original propagandistic message became highly challenged and led to the opposite result, including in the image of Paks among Hungarian cities.

5. Sources of article's financing

The research was supported by the Hungarian Academy of Sciences and the Apor Vilmos Catholic College Public Education Improvement Project 2021 – Learning Environment Research Team.

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