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Investigating commercial and convenience services installed in intermodal passenger terminals located in mid-sized European cities

Abstract: The concept of intermodality has gained key importance in the sustainable mobility strategy of the European Union. In the past two decades, different types of intermodal passenger terminals (IPTs) have been built in many European cities. These facilities provide possibility for passengers to change transportation mode or route in a short time and connect long-distance transportation services with public transportation modes under one roof. IPTs, however, are more than just hubs in the transportation network, but, due to their size and special location in the city, they are landmarks of cities. In addition, IPTs host not only transportation services but also different types of commercial and convenience services used both by passengers and local people. This study focuses on classifying IPTs based on their hierarchical position in the transportation network and determining which type is the most generally located in European mid-sized cities. Then, an investigation is carried out to map those commercial and convenience services that are the most installed in such IPT types. Finally, three European IPTs located in mid-sized cities and one in a large city are analysed to reveal the similarities and differences in the commercial and convenience services they host. This study found that such commercial and convenience services are most suitable for installation in IPTs that are related to transportation services, do not require a substantial amount of space, and do not block or obstruct the movement of people. Furthermore, as a component of the comprehensive planning documentation, a preliminary commercial feasibility study should be produced for each IPT.

Keywords: commercial and convenience services; Hungary; intermodal passenger terminal; mid-sized city

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Introduction

Recently, the promotion of intermodality has been given significant impetus in the European Union (EU) (Goletz et al., 2020). According to Pitsiava-Latinopoulou and

Iordanopoulos (2012), intermodality is an integral part of sustainable mobility and an important factor in turning congested and overcrowded cities into sustainable ones. The development of intermodal passenger terminals (IPTs) is one of the cornerstones of intermodality and sustainable mobility because it "optimizes travel conditions reclaiming the advantages of each mode being used while minimizing the negative impact that each one of them causes" (Pitsiava-Latinopoulou, Iordanopoulos, 2012: 3298). It is generally considered that the main purpose of an IPT is to integrate different types of transportation modes under the roof of one building and allow passengers to change transportation mode within the shortest possible time (Efthymiou, Papatheodorou, 2015; Yashiro, Kato, 2019). However, IPTs are more than simply the sites of transportation-related issues; they are also considered to be public places that provide services for both passengers waiting for connections and local residents. In addition, in many cases, primarily if having a central location, IPTs can be among the major landmark buildings of cities. That is, simply because of their size and central location, IPTs can significantly affect the urban landscape, and due to being public spaces, they can contribute to the creation of a vivid urban lifestyle.

When planning IPTs, the focus is generally on compliance with the interests of transportation issues. However, from the perspective of urban planning, the additional functions provided by IPTs should be considered as well. Of course, there are different types of IPTs in terms of the number of transportation modes they connect, and parallel with their importance in the local, national, and international transportation systems, the services they provide can range on a wide scale. In addition, on different continents, various types of IPTs are being built, making it difficult to classify these facilities according to the same standards.

Many large metropolitan areas in terms of population and size, primarily those that are located in the United States and Australia, contain substantial IPTs that cover an entire quarter of the city area (Henry, Marsh, 2008; Rivasplata, 2001). Because developers were provided with large vacant spaces for the construction of IPT buildings, they managed to connect all transportation modes on the ground floor, which does not require passengers to move between different floors when changing transportation mode. Regarding their size and complex urban functions, IPTs in East Asia (i.e., China, Japan and South Korea) are often referred to as station cities (Kido, 2005, 2015; Kido, Cywiński, 2014; Tsuchihashi, 2003). In Europe, however, in most cases, the IPTs have been created by the rebuilding of cities' main railway stations. Because these stations were generally located in or close to the city centre surrounded by residential and office buildings, developers had restricted possibilities to increase the horizontal extension of the building. In these facilities, varying transportation modes have often been connected on different floor levels (Bell, 2019; Bertolini, 1996; Bertolini, Dijst, 2003; Kandee, 2001; Stewart, 1995).

One of the most dynamically growing markets for the construction of IPTs is Europe. The spread of IPTs in the EU has been driven by two factors. The first factor relates to the transportation network developments that have been occurring in the EU (and its predecessors) since the mid-1950s. It has always been a major development goal of the European Community (herein, "the Community") to build a trans-European transportation network (TEN-T) connecting member states of the EU with roads, railways, airports, and water infrastructure. Since the 1970s, in Western European countries, new types of high-speed rail networks have begun to be used, such as the TGV

in France, the ICE in Germany, and the AVE in Spain. Due to these developments, by using ground-based transportation, passengers could take any routes much faster than before. The growing average speed of trains (resulting in reduced travel times) as well as the increasing comfort level and safety have made EU railways competitive with other transportation modes (Givoni, 2006). Second, around many European metropolises, large agglomerations have been formed that encompass hundreds (sometimes more than a thousand) of settlements. Daily commuting between suburban settlements and the central cities has become typical in Europe as well.

Based on these experiences, the Community has gained from the Member States independently implemented IPT developments. The European Commission (EC) has established the basic principles of future intermodal transportation developments to optimize the role of IPTs in the European transportation network (EC – CORDIS 2012; Lucietti Hoogendoorn, Cré, 2016; Pitsiava-Latinopoulou et al., 2008; Pitsiava-Latinopoulou, Iordanopoulos, 2012). In some studies issued by the EC, the IPT has been identified as the core element of the transportation network that allows passengers to change transportation mode in a short time period in a single building, and they are also provided with convenience services to spend the waiting time comfortable and efficiently. However, in many cases, developers prioritise the transportation functions of IPTs and pay less attention to the commercial and convenience services that IPTs should provide.

This is also the case in Hungary. The creation of IPTs has significantly contributed and will contribute to the improvement of the national transportation network and people's attitudes towards public transportation. However, fewer studies have investigated which commercial and convenience services and functions should be placed in IPTs to make them important and vivid public places within cities. This paper contains a systematic analysis of 100 IPTs across the world to address the above question. When conducting the analysis, I place special attention on IPTs located in Europe.

This study contains the following chapters. First, the IPT will be defined, followed by a presentation of the hierarchical structure of five levels of IPTs in terms of the types of transportation modes they connect and the location of them within the cities. Then, as case studies, four IPTs located in mid-sized European cities will be benchmarked that can be useful examples for Hungarian IPT developments (e.g., Debrecen and Nyíregyháza). Finally, those commercial and convenience services will be identified that should be optimally categorised into different IPT types.

Data and methods

Due to the national characteristics, IPTs are built, operated, and maintained differently worldwide. Furthermore, the transportation modes connected within IPTs vary from region to region (for example, trams are not typical public transportation modes in the United States and Japan). That is, IPTs may have different impacts on the cities in which they are located; however, based on a systematic analysis of IPTs worldwide, an empirical classification system can be obtained. The analysis is based upon a dataset consisting of 100 samples, out of which 67 IPTs are located in Europe, 21 in Northern America, 9 in Australia, and 3 in Japan. The data for the 100 IPTs were collected and downloaded manually from the websites of the facilities. Some additional data were extracted from the websites of the host cities. When collecting and analysing the data of the samples, I focused on the following characteristics: 1) population of the city in which the IPT

is located, 2) population of the agglomeration in which the city is located, 3) area of the city, 4) geographical position of the IPT within the city, 5) date and features (e.g., new building, rebuilding) of the IPT construction, 6) cost of the IPT project, 6) types of connected transport modes, 7) number of public transport relations, 8) number of platforms, 9) accessibility of international connections, 10) whether transport modes are horizontally or vertically connected, 11) number of passengers, 12) types of background services, 13) presence of park-and-ride (P+R) facilities, 14) whether bicycle infrastructure is available, and 15) presence of freight transport.

From the collection of 100 samples, by using cluster analysis, I selected some special cases for further and deeper examination. After implementing the Kolmogorov–Smirnov nonparametric test, I applied Ward's method for hierarchical cluster analysis. For both the nonparametric test and the cluster analysis, I used IBM SPSS 24 software. Based on the number of variables, I examined clusters containing four, five, and six elements. According to the results of this cluster analysis, Graz, Linz, and Poznań are located in the same group as Debrecen. Therefore, as possible case studies for Debrecen (and other mid-sized Hungarian cities), the IPTs in these three cities should be investigated more thoroughly.

Before examining the commercial and convenience services that should be installed in those facilities, I consider it important to define the IPT itself.

The classification of IPTs

There is no standardised definition of IPTs because it mostly reflects on the preferences of researchers. Based on the relevant literature (De Neufville, Odoni, 2003; Dohány, Kádi, 2016; Pitsiava-Latinopoulou et al., 2008; Pitsiava-Latinopoulou, Iordanopoulos, 2012; Rivasplata, 2001), we can conclude that "intermodality" is in the domain of sustainable mobility and an efficient tool for overpopulated urban areas to manage transportation issues. These studies suggest that IPTs provide the possibility for passengers to change between such transportation modes such as railways, long-distance and local buses, and other transportation modes (e.g. tram, taxi, and bicycle). Some studies investigate the municipalities' motivation in the creation of an IPT (Fleischer, 2006; Stewart, 1995), common features of planning, services that IPTs provide (Pitsiava-Latinopoulou et al., 2008, 2012), and requirements that those facilities must fulfil (Rivasplata, 2001). There are some additional works that explore passengers' preferences for IPTs (Beirão, Cabral, 2007; Ímre, Çelebi, 2017; Dell'Olio, Ibeas, Cecin, 2011; Le-Klähn, Gerike, Hall, 2014; Paulley et al., 2006; Redman et al., 2013). In Table 1, based on Nagy and colleagues' research (2018), the classification of passengers' preferences is summarised.

When scrutinising each preference, it turns out that one of the most important ones is comfort. Comfort levels pertain to not only the comfort of vehicles (e.g., trains, buses) but also of the IPT itself. Such a comfort level can be improved if it hosts more commercial and convenience services. This study aims to systematically examine those commercial and convenience services that could improve the comfort of an IPT.

Of course, the quantity and types of commercial and convenience services should be in line with the IPT type and its hierarchical position in the transportation network. In this paper, reflecting on the characteristics of IPTs, a five-tier classification was introduced.

Table 1. Preferences of people using IPTs

Ímre, Çelebi, 2017	Le-Klähn et al., 2014	Redman et al., 2013
1) prices 2) **comfort** 3) cleanness 4) reliability 5) travelling experience	1) **comfort** 2) frequency 3) information 4) social connections	1) reliability 2) frequency 3) prices 4) travelling time 5) availability 6) **comfort** 7) easy use
Dell'Olio et al., 2011	Beirão, Cabral, 2007	Paulley et al., 2006
1) waiting time 2) cleanness 3) **comfort** 4) crowding	1) travelling time 2) prices 3) travelling experience 4) social connections 5) **comfort** 6) information	1) prices 2) **comfort** 3) passenger's income 4) car ownership

Source: Nagy, Csipkés, Balogh (2018)

In many cases, IPTs' classification is based on the type of main transportation mode of which they are the core elements, such as bus stations, train stations, airports, and ports. If taking the transportation distance into account and the mixed installation of the bus and railway transportation modes, the following categories for terminals arise: those for transportation that is 1) local, 2) long distance, or 3) both local and long distance. These definitions, however, focus on only some aspects of IPTs. To obtain a more straightforward concept, a complex approach should be used that pays more attention to such features as the number of daily commuters, presence of local and/or long-distance transportation, location of the terminal in or outside the city (i.e. central location, inner-urban but not central location, location on the city's edge), catchment area of the facility, types of transportation modes being connected in it, presence of park and ride lots, and presence of commercial and convenience services. Taking the guidance of the works of Pitsiava-Latinopoulou and Iordanopoulos (2012) and Rivasplata (2001) into account, and the cluster analysis of 100 IPTs across the world, the following IPT classification system was developed:

Level 1: International (or interregional) intermodal passenger terminals (also intercity terminals)

The international intermodal passenger terminals are mostly used by passengers traveling between the major cities of a country, but they also serve as interfaces within the international transportation network. Due to these facts, these facilities host long-distance travellers for whom the waiting time can be longer than in other cases. Based on the main transportation mode that defines the IPT, four categories can be identified: 1) bus stations, 2) train stations, 3) airports, and 4) ports. By observing the location of such IPT types in a city, we can conclude that train stations are generally and traditionally located in the central areas of cities with strong integration into the cities' public transportation system. In many cases, bus stations require a larger area than train stations (transportation companies must accommodate those buses that are out of operation). Hence, bus stations are typically located outside the city centre but close to residential areas. Naturally, the locations of airports and ports are specific. It is highly

typical that airports, primarily international ones, are located in the outskirts or suburban areas of cities. However, due to the significant number of daily passengers an international airport hosts, the facilities are usually connected to the inner-urban areas via metro lines, light rail, and tram lines. The presence of these transportation modes allows people to avoid using their private cars and the costs associated with long-term parking at airports (De Neufville, Odoni, 2003). In conclusion, intercity terminals are intermodal passenger terminals located along international transportation corridors in or close to the central city of a metropolitan area and allow long-distance travellers to change routes or transportation modes.

Level 2: Regional intermodal passenger terminals (commuter transit centres)

Commuter transit centres (CTCs) serve as transportation hubs for commuters within a metropolitan region or a large agglomeration. These facilities are mostly used for daily commuting. For such commuters, the most important requirements of a CTC are easy access and short travelling times; high-frequency transportation services, ease of ability to change transportation mode, fast and comfortable ticket-buying, short walking distances, and high comfort are also considered relatively essential. CTCs are typically located in the centre of cities and serve as the focal points of local public transportation networks. In most cases, the CTCs host railway and light rail stations accompanied by local and long-distance bus stations. These facilities connect long-distance services with urban public transportation modes, such as metros, trams, and buses, and because they often lie at the intersection of major inner-urban roads (sometimes highways), they also host P+R lots, bicycle terminals, and taxi stations.

Level 3: Interchanges

Interchanges serve as the main transportation hubs of cities' public transportation networks. Because these facilities are primarily used by local passengers when changing transportation mode or route, the interchanges are typically not equipped with parking lots. In contrast, it is of key importance to make these facilities easily accessed by pedestrians and cyclists. The interchanges are generally located in or close to populous residential areas and major commercial areas in the city connecting the main public transportation lines. Because these interchanges are primarily used by local passengers for whom the most important factor is to change route as fast as possible, such facilities provide fewer amenities and services than international and regional intermodal passenger terminals. Therefore, the interchanges are equipped with such amenities (e.g. elevators and escalators) that support passengers in their easy and fast movement within the building.

Level 4: Park-and-ride facilities

The park-and-ride (P+R) facilities are located at the edge of cities and allow commuters to accommodate their cars and change to a public transportation mode that carries them to the city's inner areas. It is also important that these facilities must be easily and safely accessible for pedestrians and cyclists. In addition, P+R facilities must be connected with at least one public transportation mode.

Level 5: On-street facilities

These facilities are the stations of public transportation modes, such as buses and trams. Such on-street facilities are considered to be intermodal because they connect at least two public transportation modes (e.g. the joint station of buses and trams) and represent the most fundamental type of intermodal passenger terminals. An important difference between on-street facilities and all the other types of intermodal passenger terminals is that the former are not allowed to be used by cars; they can be located anywhere in the city because they do not require a significant amount of space that must be procured from the urban texture.

Classification of commercial and convenience services in different IPT types

As already mentioned, IPTs are complex transportation hubs that allow passengers to change transportation modes and/or routes in a short time and provide different types of commercial and convenience services for passengers to spend their waiting time usefully. Previous studies have demonstrated that the operation and, in some cases, the implementation of IPTs are significantly influenced by the commercial and convenience services the facility should host (Gebhardt et al., 2016).

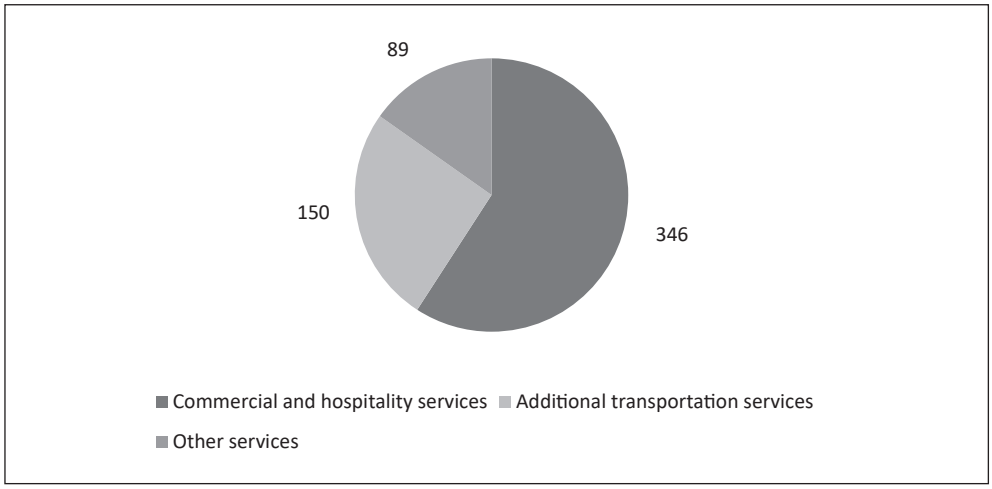
To operate an IPT facility in a profitable manner and obtain high user-satisfaction rates, it is important to develop a retail concept that provides IPT managers with guidelines about which type of additional services should be located in the facility. According to Pitsiava-Latinopoulou et al. (2008: 238), when a terminal station is designed, the objective should be the optimal usage of the available space as well as the supply of the potential demand with services in a satisfactory way. The wider the range of the services the IPT provides, the more attractive the environment for passengers is. Naturally, the most fundamental function of the IPT, irrespective of the hierarchical position it occupies, must be in connection with transportation itself. The transportation function includes the presence of P+R lots to provide long-term parking and kiss-and-ride (K+R) lots for cars to deliver or accept passengers, taxi stations, bicycle stations, ticket offices, waiting halls and rooms, lavatories, left-luggage offices, and passenger information systems. Furthermore, as Pitsiava-Latinopoulou et al. (2008: 239) note, stations located in urban or interurban places could provide the following facilities: restaurants, post offices, banking facilities, kiosk for renting cars, tourist information, and shopping areas.

To develop a clear concept of the most generally installed commercial and convenience services, 100 IPTs across the world were investigated and categorised. The broad category of commercial and convenience services was divided into sub-categories such as commercial and hospitality services, additional transportation services, and other services. One main goal of this analysis was to validate the theoretical approach of previous studies regarding the most optimal types of commercial and convenience services in IPT buildings.

First, I determined that 585 services were located in the 100 IPTs. It must be noted that this number reflects on only those services that had available information on the IPTs' websites. The 585 services were grouped according to the sub-category scheme (Figure 1 and Table 2). Approximately 60 percent of the 585 services belong to the

commercial and hospitality services category, 26 percent of them to the additional transportation services category, with the remaining services being grouped into the other services category.

Figure 1. Classification of commercial and convenience services located in the 100 IPTs into specific sub-categories



Source: author's own work based on the IPT collection of 100 samples

Table 2. Classification of commercial and convenience services into sub-categories

Commercial and hospitality services		Additional transportation services		Other services	
Service type	Number of units	Service type	Number of units	Service type	Number of units
coffee shop	63	information office	64	police station	18
shop	57	car rental	25	hairdresser's	12
restaurant	50	bicycle rental	16	business office	12
mall	25	left-luggage office	16	gym	10
newsstand	24	travel agency	15	flat to rent	8
super- and hypermarket	23	tourist information office	3	driving school	7
fast food restaurant	21	car pick and drop service	2	courier service	5
hotel	14	gas station	2	stadium	5
bakery	11	bicycle service	1	law firm	2
bookstore	11	car service	1	museum	2
grocery	10	car wash	1	printing office	2
florist	9	electric car rental	1	service point	2
tobacco shop	6	first aid office	1	accounting office	1
consumer electronics store	4	freight cargo company	1	betting shop	1
furniture retailer	4	transportation customer service	1	dry cleaner's	1
nightclub	4			optician	1

bistro	2				
confectionery	2				
ice cream shop	2				
stationery shop	2				
bicycle parts store	1				
market	1				

Source: author's own work based on the IPT collection of 100 samples

Based on the frequency of services located in different types of IPTs, I classified the commercial and convenience service regarding whether or not they were key in the operation of IPTs (see classification in Table 3).

Table 3. Classification of commercial and convenience services based on their significance in IPTs

Commercial and convenience services	Significant	Less significant or insignificant
commercial and hospitality services	coffee shop, shop, restaurant, mall, newsstand, super- and hypermarket, fast food restaurant, bakery, bookstore, hotel, grocery	florist, tobacco shop, consumer electronics store, furniture retailer, nightclub, bistro, confectionery, ice cream shop, stationery shop, bicycle parts store, market
additional transportation services	service type, information office car rental, bicycle rental, left-luggage office, travel agency	tourist information office, car pick and drop service, gas station, bicycle service, car service, car wash, electric car rental, first aid office, freight cargo company, transportation customer service
other services	police station, business office, bank	hairdresser's, gym, flat to rent, driving school, courier service, stadium, law firm, museum, printing office, service point, accounting office, betting shop, dry cleaner's, optician

Source: author's own work based on the IPT collection of 100 samples

Because these services were collected from each type of IPT as presented in Chapter 3, it was necessary to separate those that were most optimally located in IPTs positioned in mid-sized cities (being classified as CTCs and interchanges). Hence, I investigated the commercial and convenience services located in the IPTs of Graz (Austria), Poznań (Poland), Debrecen, and Nyíregyháza (Hungary).

Case studies of IPTs located in mid-sized cities

Poznań Główny railway station (2012)

As compared to the mid-sized cities being involved in the analysis, Poznań (Poland), a city with a population of almost 540,000, can rather be classified as a large city. However, because of several reasons that I present later, the city serves as a good example of efficient IPT developments.

Poznań has experienced significant development due to having been designated as one of the official locations of the 2012 UEFA European Championship. The national development program contained more than 200 project plans that were realised in Poznań and some other major cities like Gdańsk, Warsaw and Wrocław (Ferrir, 2015). In the case of Poznań, one of the flagship projects was the rebuilding of the quasi-monofunctional Poznań Główny railway station to an intermodal passenger terminal which would be capable of serving as a hub for ICs, EuroCitys, etc. The new Poznań Główny railway station, integrated with a shopping centre, cost EUR 152.5 million, and was completed and opened in October 2013.

Parallel with the IPT project, several development projects were implemented affecting not only Poznań itself but its entire agglomeration. The shopping centre has a total floor area of 60,000 square metres and hosts 200 shops being visited by 40,000 people each day. The railway station and the bus station have been integrated under the same roof and provide parking spaces for about 260 cars. On a total area of nine acres, the facility hosts not only the usual transportation functions but several cultural events as well. On the ground floor of the three-storey facility, the bus station, the railway platforms, and other additional transportation services (e.g. ticket offices) can be found. The second floor hosts a police office, shops, and left-luggage offices, while the third floor is the location for coffee shops, restaurants and fast-food restaurants.

Graz Central Railway Station (2012)

Graz Central Railway Station lies 2 km west of the city centre. The urban transportation policy of Graz (Austria) is labelled by the slogan 'Gentle Mobility' promoting walking, cycling and the use of public transportation, while endeavouring to limit motorised transportation by employing traffic calming techniques, high parking charges and limiting access for cars to the city centre (Sammer, 2009). The long-distance bus and regional railway transportation systems have great importance because the Graz agglomeration contains approximately 350,000 people, while in Styria, of which Graz is the capital and economic centre, lives a total number of 1.2 million people. Due to the large number of daily commuters (travelling by IC, Railjet, EuroCity and other regional passenger railway services), and the dominance of public transportation in Graz, it was necessary to build a high-capacity public transportation facility. Graz Central Railway Station, having been delivered to the public in 2012, integrates railway, tram and local bus transportation modes, while, by containing hundreds of parking lots, it is committed to serving as a solution to the city's parking problems. As an added value to the intermodal transportation function, the railway station hosts several commercial and convenience services, such as shopping malls, restaurants, coffee shops and a post office.

The case of Graz Central Railway Station is important because the developments have not yet been finished, indicating that the implementation of the IPT project is considered to be the core element of a complex urban development action, rather than a single development goal. In 2014, the ÖBB-Immobilienmanagement, a subsidiary of the Austrian Federal Railways (Österreichische Bundesbahnen – ÖBB) specialised in real estate developments, in co-operation with Graz' Local Government, initiated two brownfield development projects to create new city districts near the railway station. The larger district with an area of 16,500 square metres will be located west of the railway station by replacing abandoned and underused manufacturing facilities. As a result

of the project, 41,000 square metres of floor area will be built for apartments, offices, hotels, and commercial and service facilities (Loukaitou-Sideris et al., 2017). The smaller district (Railway Station Belt) with an area of 9,500 square metres and a total floor area of 21,000 square metres will have similar functions to the larger district. Furthermore, based on the well-developed transport infrastructure, the local government of Graz decided to involve the district in its smart city project under the title Smart City Project Graz Mitte. The main goal of the ongoing smart city developments is to create a near-zero emission city district offering a home to around 1000 apartments, offices, educational and leisure activities, and large green fields. A key element of the project was the building of the 60-metre-high Science Tower in 2014, a 100 percent energy efficient building, promoted as the lighthouse of Smart City Graz (http://www.graz-city-ofdesign.at/de/output/detail/221/der-science-tower).

Debrecen IPT (under planning since 2016)

The transportation infrastructure of the city of Debrecen is considered to be well developed. However, the full integration of the public transportation modes located in the city has not yet been carried out; for example, the long-distance bus station is currently located 2 km from the closest tram station. The main goal of the IPT project is, on the one hand, to improve the local transportation options serving the needs of residents and commuters and, on the other hand, to revitalise the surrounding areas of the railway station. The preparation of the project was initiated approximately one decade ago with the creation of several feasibility studies. After developing the engineering plans and other corroborative documents by 2016, all the technical documents are now available to rebuild the railway station and revitalise the surrounding areas. The IPT will preserve the architectural structure of the old station building, but by attaching new building sides and creating large transportation areas and green fields, the total area of the facility will grow to 150,000 square metres (Figure 2).

Figure 2. Planned Debrecen IPT facility

Source: Municipality of Debrecen

The long-distance and local bus stations will be integrated into a new underground station on a total floor area of 12,000 square metres. In addition, a three-story parking house with 390 lots will be built, containing both P+R and K+R areas. The main terminal of trams is now located opposite the railway station, but in the new IPT building, it will be more harmonically integrated into other transportation modes. The railway station building, as is the case in Graz, will be constructed to preserve the architecturally valuable parts of the old building. In the new annexes having a total area of 4,500 square metres, business offices, commercial spaces, administrative offices, and restaurants will be installed. Commercial feasibility studies examining the profitable operation of the facility recommend that besides the aforementioned functions, bank offices, bakeries, telecommunication offices, insurance companies, supermarkets, pharmacies, health centres, and public service offices (e.g. offices of utility companies, post offices) should also be located.

Nyíregyháza IPT (under planning since 2015)

The main goal of the IPT project of Nyíregyháza is to connect the local public transportation modes with the railway to harmonize the city's transportation network. In this case, it was vital to determine which commercial and convenience services contribute most effectively to the operation of the facility. Comparing the current size of the railway station that is intended to be the location of IPT, the new building will cover a significantly larger area (Figure 3). Therefore, the project requires approximately 32 million Euros, which is a remarkably high amount if we are aware of the fact that the city's public transportation system is based on buses exclusively. It is, however, a main goal of Nyíregyháza to establish a new tram line that will relate to the local and long-distance bus systems in the IPT. In addition, the facility will host P+R and B+R parking lots as well as taxi stations. To maintain the facility in a profitable manner, the developers are committed to creating many places that will serve commercial purposes.

Figure 3. Planned Nyíregyháza IPT facility

Source: https://www.unitef.hu/imcs-nyiregyhaza, download: December 23, 2020

It is expected that the IPT will host such commercial services as business offices, restaurants, shops, pharmacies, public administration office, post office, coffee shops, bakery, and newsstands.

These four facilities are located or will be located in mid-sized cities (the population of Poznań is almost three times higher than that of Debrecen and Graz, but in the European urban system, the city is considered to be relatively large), yet the types and number of commercial and convenience services being provided vary from IPT to IPT.

Comparison of Poznań and Graz IPTs with Debrecen and Nyíregyháza IPTs based on commercial services

Based on the results described above, I found that Poznań and Graz are considered the most optimal examples for IPTs planned to be built in (large and) mid-sized cities located in Central and Eastern European (CEE) countries, including Hungary. These results were also reinforced by the cluster analysis.

As can be observed in Table 4, the IPTs in Hungary will host more types of commercial services (Debrecen: 25, Nyíregyháza: 23) than those located in Poznań (10) and Graz (14). Parallel with the planning of the Debrecen and Nyíregyháza facilities, the developers ordered commercial feasibility studies carried out by CBRE Group (CBRE, 2016, 2017). These analyses demonstrated that the largest proportion of the IPT buildings' commercial spaces must be used to host services listed in Table 3 to make the facility profitable. The commercial service packages offered by CBRE Group are in line with the ones indicated in Table 2 (i.e. they are typical in the IPTs located in mid-sized cities).

Table 4. Commercial services provided by IPTs in selected cities

	business office	restaurant	grocery	other types of shop	drugstore	public administration office	post office	coffee shop	real estate office	bakery	pharmacy	newsstand	betting office	money change office	perfumery	gift shop	florist	dry cleaner	tobacco shop
Poznań	0	2	1	0	1	0	0	2	0	0	0	2	0	1	0	0	0	0	1
Graz	0	3	2	0	0	0	1	3	0	1	0	2	0	0	1	0	0	0	1
Debrecen	3	3	1	0	1	1	1	2	2	2	0	1	1	2	1	1	1	1	1
Nyíregyháza	1	5	1	1	1	1	1	1	0	2	1	1	1	1	1	1	1	1	1

Source: own construction based on the IPT collection of 100 samples and the commercial feasibility studies carried out by CBRE Group (2016, 2017)

Conclusion

This paper investigated the most used commercial and convenience services in intermodal passenger terminals (IPTs) located in mid-sized cities. First, it was necessary to classify IPTs to determine which type is most typically located in mid-sized cities,

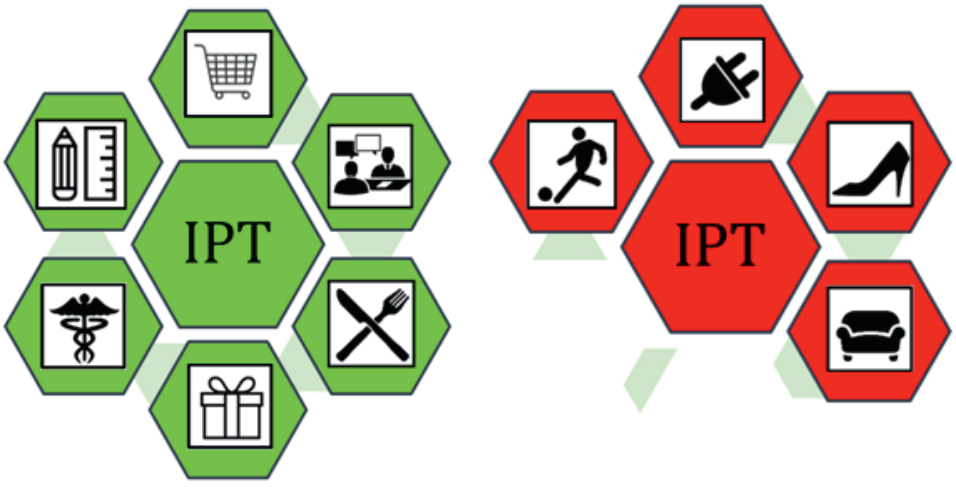
with particular respect to European cities. I investigated the characteristics of 100 IPTs worldwide and, based on the results, classified IPTs into five categories. It turned out that mid-sized cities most generally host commuter transit centres and interchanges, but in European mid-sized cities, the latter are preferred.

After classifying IPTs across the world, I mapped the commercial and convenience services that IPTs most commonly hosted. The 53 types of commercial and convenience services can be grouped into three sub-categories, out of which most services belong to the group of commercial and hospitality services. Then, I examined four case studies – three of which were the IPTs of Graz, Debrecen, and Nyíregyháza (the latter two facilities are under planning or construction) to determine which of the commercial and convenience services were the most typical in mid-sized cities – as well as Poznań, a large Polish city, because its IPT provides some remarkable examples for Hungarian cities. This investigation provides a reminder that for European mid-sized cities that host interchanges, the focus should be on commercial and hospitality services, with a dominance of commercial services. The reason for this focus is that interchanges are not only the main transportation sites for passengers who want to change transportation mode or route in a rapid manner but are also important city entry points. In addition, for local people, the IPT serves as the main public transportation hub and is considered a vivid public place and city landmark.

Based on the above description and analysis of commercial and convenience services of the 100 IPTs worldwide with special attention on four case studies, I recommend that the following scheme be considered during the IPT design of mid-sized cities (Figure 4).

Naturally, during the design of an IPT facility, other factors should be included as well, such as those stemming from urban planning issues (Bodnár, Csomós, 2018, 2019).

Figure 4. Commercial and hospitality services that are (and are not) recommended for IPTs located in mid-sized cities



Source: author's own work based on the IPT collection of 100 samples

A limitation of this study is that it focused on only a handful of IPTs. Hence, future research should analyse a larger number of IPTs. This work could be relatively challenging because, for many IPTs, the necessary data are not publicly available. Hence, the IPTs and host cities should be asked to provide information for such research. In addition, some non-European IPTs should also be investigated because they might serve as useful examples for the European intermodal efforts.

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