EUROPA XXI
Vol. 46, 2024, pp. xx-xx
https://doi.org/10.7163/Eu21.2024.46.2

Institute of Geography and Spatial Organization
Polish Academy of Sciences

SUSTAINABLE URBAN MOBILITY PROGRAMS THAT SERVE AS ACTIVE TRAVEL TO SCHOOL PROGRAMS IN HUNGARY: THE CASE OF PEDIBUS AND BICIBUS

Petra Kinga Kézai [1 2]

[1] HUN-REN Center for Economic and Regional Studies
Liszt Ferenc u. 10., H-9022 Győr: Hungary
kezai.petra@krtk.hun-ren.hu

[2] Department of Corporate Leaderships and Marketing, Kautz Gyula Faculty of Economics, Széchenyi István University
Egyetem tér 1., H-9026 Győr: Hungary
kezai.petra.kinga@sze.hu

Abstract. In the context of modern, sustainable urban development, various socio-technical innovations have proliferated in response to urban challenges, offering well-defined solutions. Since the 1970s, the so-called 'backseat generation', a group of children whose parents drive them to school daily, has emerged in developed countries, particularly in urban areas. This phenomenon has many adverse effects on children, the environment, and urban spaces. The present study addresses the issue of urban transport management, in particular, the issue of daily active transport to school. Based on literature analysis, it aims to present good international examples, such as the pedibus and the bicycle bus, which emphasize local values and resources in the light of the ‚slow city' concept. The study concludes with a presentation and evaluation of the pilot programs (Pedibus in Gödöllő and Bicibus in Pécs) that have been established in Hungary in recent years. These programs provide a supervised, safe, group-based solution for school children and their families to get to school and build community between different generations.

Keywords: active travel to school, bicycle bus, community mobility, community organization, pedibus, 'slow city' concept, sustainable urban mobility, urban mobility, walking school bus.

Introduction

In the 21st century, the world's rapidly growing population lives in urban areas, making urban growth and urbanization one of the main global challenges of our time (Săgeată et al., 2023). The continuous expansion of these areas has resulted in a significant increase in the need for mobility as part of everyday life (Kaufmann et al., 2004; Urry, 2012; Sunitiyoso et al., 2023; Tori et al., 2023). Maintaining mobility in urban spaces is a constant challenge for cities (Santinha et al., 2021). Changes in lifestyles have fundamentally transformed travel patterns which are expected to continue in the future (Starikova, 2018).

Sustainable urban mobility is crucial in Europe because more than 70% of EU citizens reside in urbanised regions (cities, towns, and suburbs), where 23% of all transport-related

greenhouse gas emissions originate. In order to achieve the objective of decreasing greenhouse gas emissions by a minimum of 55% by 2030 and 90% by 2050, the Urban Mobility Framework initiative recommends measures to motivate European Union Member States to create urban transportation systems that are secure, easy to use, affordable, technologically advanced, adaptable, and pollution-free (EC, 2023). Incorporating sustainable urban mobility principles into workplace well-being initiatives and management practices offers a dual benefit: it not only boosts employee satisfaction but also advances corporate environmental goals (Ton et al., 2022; Gelencsér et al., 2023). The adaptation of the population to this EU directive in Hungary may cause some challenges due to the urban population's attitude towards the environment, as the ranking of sustainability awareness is: village, town, county seat, followed by the capital (Vinkóczi et al., 2023). Innovative urban development solutions aim to address these challenges novelly, improving urban society's quality of life and increasing urban systems' operational efficiency (Uszkai, 2016; Faragó, 2024). However, local communities and their attitudes towards and openness to innovation play a vital role (Bertalan, 2020; Buics et al., 2023).

The research focuses on urban transport management, specifically the daily active transport to school (ATS), which affects a wide population range. In Hungary, congestion around schools from September to June is a significant problem for the environment and cities. This publication aims to identify good practices that can support urban mobility and encourage school children to be more mobile. What successful programs have been implemented abroad that can be adapted in Hungary to promote environmentally conscious and active lifestyles among school children by reducing car usage? This research examines this issue by presenting successful urban development innovations such as the pedibus and the bicycle bus. Agyeman et al. (2023) aimed to bridge the gap between practitioners and academia by providing a pathway for applying good practice.

The paper presents the methodology and the literature review of innovative urban development programs, including the slow city concept, the pedibus, and the bicycle bus, followed by an overview of the models adopted in Hungary. Finally, it highlights two sustainable urban mobility programs for school attendance as good practices based on interviews: the pedibus in Gödöllő and the bicycle bus in Pécs. The paper concludes with suggestions, conclusions, and future research directions.

Methodology

The research area was investigated using a literature review followed by a quantitative phase of semi-structured, in-depth interviews (n=11) with the founders of sustainable urban ATS programs in Hungary.

Literature review

The literature analysis aimed to identify studies published in open-access scientific journals in English between 1998 and 2023. The research was conducted using the keywords 'active travel to school (ATS)', 'pedibus', 'walking school bus (WSB)', and 'bicibus' in the scientific databases Web of Science, Scopus, and Google Scholar on the 9th of November 2023.

The Research area

The analysis centers on Hungary, situated in Central-Eastern Europe, spanning 93,030 square kilometers with a population of 9,597,085 (HSO, 2023a). Within this, the overall school-age population is 1,925,960 for individuals between 3-22 years, as illustrated in Figure 1 (HSO, 2022a).

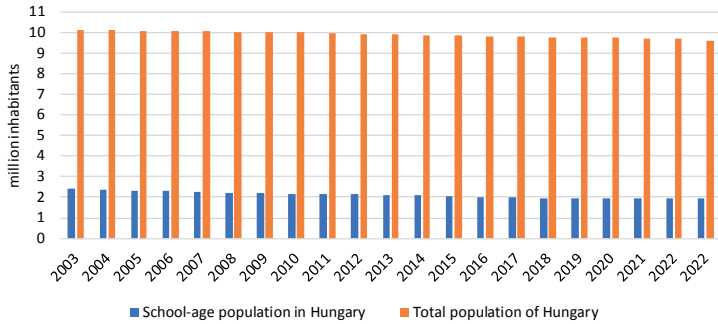

Figure 1. The population and the school-age population in Hungary
Source: HSO (2022a, 2023a).

In the 2022/2023 academic year, enrollment in education across multiple levels in Hungary reached 1.852 million, with 719,000 registered in primary schools (HSO, 2023b). A recent study describes alternate ATS programs for these primary school children (7.5% of the population) in Hungary.

The semi-structured interviews

The study conducted eleven semi-structured interviews based on Babbie's (2021) work. A snowball method was used to select the interviewees. Initially, the most well-known program organizers were contacted, including Gödöllő, Pécs, and the Hungarian National Cycling Club, followed by all other stakeholders (n=11). In-depth interviews were conducted via phone and Zoom platforms between June 2023 and January 2024, and Figure 2 provides a summary of their locations.

Figure 2. The interviewees as ATS organisors in Hungary
Source: own compilation.

Following a constructivist approach to interviewing, we opted for active interviewing (Holstein, 1995). In a process called a traveling interview, the interviewer and interviewees jointly generate significance as co-participants in knowledge construction (Holstein, 1995). The interviewee has the chance to ask questions while the interviewer refrains from providing a subjective interpretation. This allows the interviewer to rephrase the answers if they are unclear (Brinkmann & Kvale, 2015).

The interview consisted of seven structured questions, which can be viewed in Appendix 1. A 30-45 minute online or phone interview transcript was created. The transcript was analyzed using Brinkmann and Kvale's (2015) ad hoc analysis method. We devised a bespoke analytical approach that aligns with our research theme. We contextualized the interview data against pre-existing knowledge and insights uncovered during the investigation. This ensured that the interviewees' perspectives were reconciled with those of the other participants and the analyst (Kvale, 1996).

Research background

This section first presents the 'slow city concept' as an innovative urban development program and then the 'sustainable urban mobility program', focusing on active school transport programs such as pedibus and bicibus.

The concept of slow city as an innovative urban development program

When reviewing innovative urban development programs, mentioning the slow city concept is essential, which has gained popularity in recent years (Zadęcka, 2018). In 1986, an Italian journalist named Carlo Petrini led a protest against opening a McDonald's fast food restaurant in one of Rome's most beautiful squares, Piazza di Spagna. Although the protest was unsuccessful, his promoted vision grew into a movement. In October 1999, Paolo Saturnini, the mayor of Greve-in-Chianti, and the mayors of three other municipalities (Orvieto, Bra, and Positano) founded a new innovative model called the slow city (Italian *cittá slow*). This approach aimed to counteract the rushing, over-consumption-oriented, globalized lifestyle of the time, divorced from local values. The slow concept is ambivalent towards globalization as it emphasizes local values and locally available cultural and economic resources (Mayer & Knox, 2006). Its principles include pursuing a calmer and less polluted physical environment, preserving local aesthetic traditions, and promoting local crafts, products, and cuisine.

The aim is to utilize technology to promote a healthier environment and shape attitudes. The concept seeks to raise community awareness about the value of a more relaxed pace of life and encourage them to share their experiences for a better quality of life (Knox, 2005).

The movement has also extended to various other areas of life, with the emergence of: SlowBook, SlowCity, SlowDesign, Slow Food, SlowMoney, SlowLiving, SlowSchool, SlowSport, SlowTravel, and SlowWork. However, only the Slow Food movement has achieved global success and now has global networks (Petrini, 2013; Bertalan, 2020).

Sustainable urban mobility programs

In recent years, various programs have been initiated in Europe and Hungary to enhance mobility, sustainability, and healthy lifestyles. One example is *Pedelek*, a program of the Hungarian Ministry of Innovation and Technology linked to the Climate and Nature Action Plan. For instance, *Pedelek* encourages car drivers to transition to cycling by purchasing electric bicycles with state

funding. The program strives to decrease air pollution while improving public health, according to the World Health Organization (2021).

Table 1 summarises the result of the literature review on bicibus and pedibus.

Table 1. Literature review on Bicibus and Pedibus

Research goal	Study area	Student's age (yrs)	Reference
Active school attendance interventions	Canada, USA	3-19	Buttazzoni et al. (2018)
Promoting active physical activity	New Zeland	5-17	Smith et al. (2019)
	Christchurch, New Zealand	5-17	Kingham & Ussher (2005, 2007)
	Cordoba, Spain	5-12	Pérez-Martín et al. (2018)
	USA	2-18	Heelan et al (2009)
	Carolina, USA	0-17	Pate et al. (2016)
	Columbia, Canada	6-19	Mah et al. (2017)
	Cordoba, Spain	6-12	Pérez-Martín et al. (2018)
	Liverpool, Scottland	2-15	Lewis et al. (2010)
Promoting active physical activity and sustainable mobility	Auckland, Australia	9-11	Kearns et al. (2012)
Promoting active physical activity and social networking	New Zealand	6-12	Kong et al. (2009)
	Switzerland	4-8	Naef (2017)
Safe transport	USA	0-17	Cradock et al. (2012)
	Houston, USA	9-10	Mendoza et al. (2012)
Health benefits	Systematic literature review	5-11	Jones et al. (2020)
Sustainable mobility	Emilia Romagna, Italy	–	Pellicelli et al. (2022)
	Italy	–	Maltese et al.(2021)
	Palermo, Italy	14-19	Migliore et al. (2021)
	Kandy, Sri Lanka	10-18	Dias et al. (2022)
School attendance patterns	Bradford, United Kingdom	2-15	Nikitas et al. (2019)
	San Francisco, USA	10-14	McDonald & Aalborg (2009)
	Auckland, New Zealand	8-13	Ikeda et al. (2020)
	Viktoria, Australia	6-12	Sahlqvist et al. (2019)
	Scottland	10-11	Waygood et al. (2015)
	Cairo, Egypt	4-18	El-Dorghamy & Mosa (2016)
The link between school choice and distance	London, United Kingdom	6-10	DiGuiseppi et al. (1998)
Optimal pedibus route planning	Theoretical paper	–	Malucelli et al. (2017, 2018)
Wellbeing	Osaka, Japan	5-17	Waygood et al. (2015, 2020)

Source: own compilation.

In the context of the slow city concept, this study focuses on sustainable urban mobility programs such as Active Transport to School (ATS) schemes. Walking and cycling to school buses are popular mobility concepts that promote children's interest in active transport to and from school. They also reduce dependence on private cars, decrease city pollution, and encourage healthy lifestyles (Agyeman et al., 2023). The topic is significant due to the alarming rise in obesity rates among children and adolescents in developed countries since the 1970s (Pate et al., 2016). Since the 1970s, a generation of children known as the 'backseat generation' has emerged (Karsten, 2005), with parents driving them to school daily (Mah et al., 2017). Although WHO (2022a, 2022b) reports recommend more significant physical activity from school age onwards, contributing to children's physi-

cal, mental, and social well-being, the frequency of active school travel among children is declining in many developed countries (Ikeda et al., 2020).

The analyzed studies covered nine key areas: interventions promoting active travel to school, physical activity promotion, safe transportation, health benefits, sustainable mobility, school travel habits, school choice and distance, optimal route planning, and psychological well-being. Research on this topic has mainly been conducted in developed Western countries, including the United States, the United Kingdom, Australia, Canada, Italy, Mexico, Scotland, Spain, and New Zealand, as well as Egypt, Japan, and Sri Lanka, as noted by Agyeman et al. (2023). On the European continent, the only countries where studies on this subject have been carried out are Ireland, Italy, Scotland, and Spain. Consistent with work by Agyeman et al. (2023), further exploration of urbanized areas, including countries in Central and Eastern Europe, such as Hungary, where ATS programs are still in their infancy, would be worthwhile. School children's age range is inconsistent, with the broadest definition ranging from 0-19 years. This suggests that it may vary according to the school system in each country. In summary, the literature analysis concludes that sustainable urban mobility programs, such as the pedibus and bicycle bus, support both community and individual goals by promoting physical activity, well-being, and safe transport. The following section presents an overview of developing and disseminating the pedibus and bicycle bus programs.

Pedibus

The phenomenon of pedibus has been denoted by various terms in literature, with pedibus or its English equivalent, 'walking school bus' (WSB), being the most prevalent (Engwicht, 1992; Cradock, 2012; Ikeda et al., 2019). In Italy and Western European nations, it is referred to as '*a piedi a scuola*=pedibus' (Maltese et al., 2021; Migliore et al., 2021; Pellicelli et al., 2022), while in France it is known as '*le Pédibus*', and in German-speaking regions, it is called '*Pedibus*'. Kong et al. (2009) define the WSB as a group of children accompanied by one or more adults who walk to and from school.

In 1962, the Ministry of Education, Culture, Sports, Science, and Science in Japan initiated and expanded the WSB system nationwide, which only accompanied students to school and not on their way back home. The successful implementation of this system was captured in a 1963 Japanese documentary film, *shuudantōgekō* (集団登下校). The WSB concept originated in Japan (Waygood et al., 2015; Waygood & Taninguchi, 2020). However, Australian creative designer and urbanist David Engwicht credited its expansion to Anglo-Saxon countries. In his book 'Towards an Eco-City – Aiming to Ease Traffic,' published in 1992 (Engwicht, 1992), Engwicht wrote about the low-cost, sustainable, and eco-friendly concept of the WSB, which involves children walking to school in groups supervised by adults.

The idea was first recognized and applied in Canada in 1996 under the Active and Safe Routes program, and then Switzerland adopted it in 1999, establishing the first WSB in Lausanne, leading to over 1500 routes being organized to date (Pigalle, 2018). Since 2010, WSB has also been implemented in South Korea under the Safe Kids Korea program (Waygood et al., 2015; Sul et al., 2015). This urban innovation has spread worldwide, with pedibus services beginning in many countries, from Austria to America and Europe to Asia (Kingham & Ussher, 2005, 2007).

The WSB program targets school children (typically aged 2-18) with the double objective of promoting walking to school and alleviating morning traffic congestion around schools by reducing congestion at school gates. This initiative aims to legitimize walking as a sustainable mode of transportation in the long run (Mendoza et al., 2012; Malucelli et al., 2017). The group adheres

to a prearranged route to reach school on a fixed timetable, similar to a bus, and can join students at designated stops (Fig. 3) (Engwicht, 1992).

Figure 3. Pedibus stop sign in Livigno, Italy
Source: author's photo.

Bicibus

An alternative to the walking school bus is the bicycle bus. It is a group of children cycling to school with adults, such as parents, volunteers, and sometimes teachers (Beneyto et al., 2022; Kotsila et al., 2023). The bicycle school bus concept is equally free, safe, supervised, and all-weather. The cycling group is accompanied by a driver pilot at predetermined times, usually in the morning and after school hours in the afternoon, along a predetermined route (Mendoza et al., 2017). Safety equipment, such as helmets, vests, puncture repair kits, pumps, or bicycles, is provided to participants in a supportive environment (Agyeman et al., 2023).

In the autumn of 2021, five Spanish families launched the Bicycle Sustainable Mobility Programme in Sarrià, Spain (Fig. 4).

Figure 4. Bicibus in Spain
Source: BS (2023).

Every Friday, parents and children cycle together to seven schools in the district, taking over previously busy city streets (Wati & Tranter, 2015). The bicycle school bus offers several advantages. Firstly, it is an environmentally friendly mode of transportation. Secondly, it provides a safe space for children to walk to school. Finally, it reduces urban car traffic and fosters a sense of community through the shared experience of cycling together (Kotsila et al., 2023).

In March 2023, Barcelona hosted the inaugural 'Bicibus Summit 2023', an international event that brought together bicycle enthusiasts and organizers worldwide to exchange ideas and experiences. The summit aimed to promote sustainable urban mobility and inspire the launch of bicibus programs in cities worldwide (BS, 2023).

Results

Overview of sustainable urban active travel to school programs in Hungary

In Hungary, the ATS program in bicibus and pedibus has been developed in response to sustainable urban mobility programs in other countries. Based on the semi-structured interviews (n=11), Table 2 summarises the main characteristics of these initiatives launched in 2021.

Table 2. ATS programs for primary school students in Hungary in 2023

Interviewees	ATS programs	Founder	Location	Foundation date	Lines in operation	Schools involved
1	Pedibus	Civil organisation	Budakalász	2021 September	8	3
2		Municipality	Gödöllő	2021 November	4	4
3		Civil organisation	Pomáz	2023 January	0	1
4		Civil person	Szentendre	2023 January	0	3
5		Civil organisation	Vecsés	2023 November	3	1
6	Bicibus	Civil person	Pécs	2022 September	1	2
7		Civil organisation	Verőce	2022	1 (since February 2023, 0 lines)	1
8		Civil organisation	Budapest (Zugló)	2022 October	3	3
9		Civil person	Zirc	2023 July	1	1
10		Civil person	Baj	In planning		
11		Municipality	Budapest (Ferencváros)			
Total	11				21	19

Source: own compilation.

The Pedibus service was first introduced in Budakalász in September 2021, following the example of Sfântu Gheorghe in Romania, as a grassroots initiative. Later, Gödöllő adopted the service in November 2021, followed by Pomáz and Szentendre in January 2023. Other municipalities like

Göd and Miskolc have also expressed interest in adopting the initiative. The most successful pedibus program operates in Budakalász. School children have access to 8 pedibus lines daily, connecting three schools: Kalász Primary School, Patakpart Primary School, and Szentistvántelep Primary School. The initiative is organized from the bottom up, with parents of local school children initially orchestrating the program. Later on, civil organizations founded by these same parents took over. The program in Gödöllő is an exception to this pattern as it was founded from the top down. Additionally, Budakalász is noteworthy due to a generational shift in the leadership of the pedibus program. The offspring of the original trio of founders have now progressed to the fifth year of elementary education and have gained independence in their commute to school. Therefore, the responsibility for managing the program's knowledge, marketing, organization, communication, and accountability has been seamlessly handed over to the parents of a year one pupil. This emphasizes the importance and pivotal role of the initiative's organizer, who acts as a change agent within the local authority, connecting the municipality with schools, students, and families. If the change agent lacks sufficient dedication to the innovation, it may fail to attract an audience, as demonstrated in Szentendre and Pomáz.

Since 2021, the number of sustainable ATS programs in Hungary has steadily increased. As a result, these innovative urban and rural development solutions are being implemented in more and more places. Until the end of 2023, 11 municipalities, 20 lines, and 18 primary schools were involved. Cooperation between sister municipalities could provide opportunities for exchanges, sharing of experience and knowledge, and even collaboration in tenders within the framework of ATS programs.

However, it is worth noting that, except for Gödöllő, where the local government is involved, all of these programs are run by dedicated individuals committed to creating a better future. These initiatives were established by civilians and civil organizations (Everyone's Szentendre Association, Pomázi Civil Alliance, Eleven Civil Organization, Dunakanyar Bicycle Club, and Hungarian Bicycle Club). The programs are often implemented by volunteers sacrificing their own free time and resources, making the role of the civil organizer indispensable. The case of Verőce proves this point: in 2023, *Bicibusz Verőce* was nominated for a Civil Award in the best local initiative category and was eventually evaluated among the top 25 projects (CD, 2023). However, in February 2023, the organizer could not continue his daily activities, resulting in the discontinuation of the Verőce bicibus. However, due to the implemented change in mindset, the bike racks in front of the school are still full, and now the students themselves ride their bikes to school.

Case studies

In the paper's last part, we present two exemplary Hungarian social innovations. The first is the only top-down organized *Pedibus of Gödöllő*, a unique ATS program serving community building. The second example is the case of the only traditional Hungarian *Bicibus Pécs*, which operates weekly in the city of Pécs.

Pedibus Gödöllő

The sole exception among the bottom-up initiatives resides in Gödöllő, where the Chief Architect and her colleague followed exemplary European models from countries such as Italy, Switzerland, and Sfântu Gheorghe, Romania, to create a unique pilot program for urban development called Pedibus Gödöllő, in line with the slow city movement. The city, which has a population of 31,494 inhabitants (HSO, 2022b), aims to reduce morning traffic congestion around primary

schools. This will create a more sustainable and livable environment in the city while also influencing the long-term attitudes of the population. The Municipality of Gödöllő has been planning to launch a pedibus service since 2019, but closures and the coronavirus pandemic have hindered their efforts. The program has the unique feature of promoting environmental protection and awareness while also facilitating intergenerational networking and community building. The volunteer chaperones, referred to as pedibus drivers, are primarily members of nearby pensioner organizations or retired educators. Around 20 of the 28 volunteer drivers are active pensioners aged 65 or over. This program is well-received by both the local community and the national and international media. It is based on a unique social partnership that provides children with a healthy alternative to attending school. Additionally, it offers the local pensioners regular activities and morning walks in the fresh air, which is crucial for maintaining their health.

Lastly, pedibus Gödőllő aims to reduce social isolation and potential loneliness experienced by elderly individuals by facilitating engaging interactions with cheerful and talkative schoolchildren, who often view the kind retired pedibus drivers as substitute grandparents, and these daily interactions through the Pedibus services culminate in the formation of meaningful relationships.

The children receive a sticker for each trip, which they can place in their booklet. When the booklet is complete, they receive souvenirs featuring the Pedibus logo, such as sports bags, canteens, and raincoats, to encourage further participation.

Additional services and further development of the concept are planned, potentially in the form of an application, that could serve also as a sport and lifestyle application (Keller & Ercsey, 2023). The organizers aim to enhance the sustainable walking-to-school campaign and participate in national programs like Active Hungary (HCC, 2022). They have compiled their knowledge into a comprehensive pedibus guidebook, which they will distribute to interested mayors and professionals seeking to integrate the phenomenon into their locality.

Bicibus Pécs

The only remaining traditional bicibus, which operates continuously in Hungary, is currently stationed in Pécs, the capital of Baranya County, in southern Hungary. Every Friday, volunteers help students who cycle to Ciszterci Education Centre and Leőwey Klára School via three designated routes throughout Pécs. Bicibus Pécs is a grassroots organization with a bottom-up structure. Its founding and ongoing operation are attributed mainly to local resident Simon Winterman, who moved to Pécs from the Netherlands. Mr. Winterman aims to change the Hungarian public's perception of cycling as a healthy and essential means of transportation that improves the city's livability. On 15 January 2024, the program was awarded the Green Pécs award, making Pécs an example for all municipalities interested in promoting sustainable urban mobility. The Pedibus Foundation of Pécs planned to commence operations in September 2023 and aims to extend the independent program to more institutions. Pedibus Pécs is an example for all local councils interested in promoting sustainable urban mobility. In recent years, the Hungarian Cycling Club has produced a guide for organizing the scheme, which can serve as a reference for those who organize bicycle buses (BOG, 2023).

Discussion and conclusion

The article analyses ATS programs focusing on pedibus and bicibus adapted in Hungary, demonstrating the potential for social innovation in sustainable urban development by promoting active mobility to school and reducing dependency on cars. These initiatives, as in the case of bicibus Verőce and pedibus Gödöllő, have not only contributed to environmental sustainability but have also fostered a sense of community and social interaction.

As urban populations continue to grow (Săgeată et al., 2023) and environmental concerns become more pressing (Lieszkovszky et al., 2021), the lessons learned from these programs can serve as a blueprint for addressing transportation and social challenges in diverse urban settings. Embracing and supporting such initiatives is critical to building resilient and vibrant cities, prioritizing the well-being of the environment and the people living there. The success of these programs demonstrates the importance of involving citizens and bottom-up organizations in the design of urban mobility solutions and highlights the potential of alternative transport modes in addressing environmental and social challenges in urban areas. Such initiatives can create more sustainable, liveable, and inclusive cities. Furthermore, the success of the Pedibus and Bicibus programs highlights the importance of collaborative efforts between local governments, civil society organizations, and community members to promote sustainable urban development. These initiatives have resulted in innovative transport and community engagement approaches, setting an example for other cities to follow.

On the other hand, while the Pedibus and Bicibus programs have shown promise in promoting sustainable urban development, certain limitations and challenges need to be considered. One of the main problems is the scalability of these initiatives. The success of these programs in Hungary is not necessarily transferable to other urban areas with different geographical features, infrastructure, population density, and cultural norms. It is essential to highlight the importance of the organizer (Lipták, 2019), since, as the case of the Bicibus in Verőce showed, the initiator stops without the role of innovator.

Furthermore, the success of these programs in promoting social interaction and community engagement may depend on local cultural factors and may not be easily replicable in different urban settings. This was the case in Szentendre and Pomaz, where local parents could not be persuaded to change their children's school attendance habits.

Moreover, the transition towards alternative modes of transportation may require significant infrastructure and resource allocation adjustments, which can be a major hurdle for many cities. Therefore, it is proposed to introduce additional Operational Programmes for Spatial and Urban Development, such as Zirc, to encourage cycling and walking mobility in Hungarian cities, using low-impact modes of transport such as bicycles and pedibuses. These methods promote health and community building while having a minimal impact on the environment (Pirlone & Spadaro, 2020). Additionally, Hungary should consider implementing a program similar to Italy's National Prevention Plan (2020-2025), known as *Health Promoting Schools*, based on the WHO's Health Promoting Schools approach. This approach aims to create pedibus networks throughout the country. It is crucial to adapt successful models from other nations for future use. To enhance this, it is worthwhile to strengthen connections between cities, including municipality sistering. Also, the Bicibus Summit was the inaugural global meeting of Bicibus organizers to exchange ideas and inspiration and to catalyze a new phase of sustainable transport for children (Sahlqvist et al., 2019).

To sum up, promoting active transport for school attendance and reducing car use can have environmental and community benefits. This remains entirely applicable in 2024 and is particularly

important for urban areas to maintain their quality of life (Malucelli et al., 2018). Regarding future research, it is necessary to optimize existing ATS programs to ensure optimal usage, particularly in countries where these modes of transport have not yet been investigated or implemented, such as Central and Eastern Europe.

Acknowledgement

Project no. 146411 has been implemented with the support from the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, financed under the K-23 funding scheme.

References

Agyeman, S., Alimo, P. K., Donkoh, V., & Cheng, L. (2023). Toward cleaner production of walking school buses and bicycle trains: A systematic review. *Journal of Cleaner Production*, *426*(10), 139031. https://doi.org/10.1016/j.jclepro.2023.139031

Babbie, E. (2021). *The Basics of Social Research* (15th ed.). Hampshire: Cengage Learning.

Beneyto, M., Collet, J., & Garcia, M. (2022). Towards an Inclusive Community: Without the Whole Context There Is No Real Inclusion. In J., Collet, M., Naranjo & J., Soldevila-Pérez (Eds.). *Global Inclusive Education: Lessons from Spain* (pp. 127–139). Cham: Springer International Publishing.

Bertalan, L. (2020). Társadalmi innovációk a városi problémák kezelésében. (Social innovations to tackle urban problems). In V., Szirmai (Ed.). *Középvárosi társadalmak. Egy új, innovatív városfejlesztési modell megalapozása* (pp. 49–60). Sopron: Soproni Egyetem Kiadó.

BOG (2023). Bicibusz szervezési segédlet (Bicibus organisation guide). Retrieved from https://www.bringazzamunkaba.hu/bicibusz-szervezesi-segedlet/?_gl=1*1xf963m*_up*MQ..*_ga*MTQ5MDM1NDM4OC4xNjg3NDk5OTI0*_ga_1GJBB7V6RC*MTY4NzQ5OTkyMy4xLjAuMTY4NzQ5OTkyMy4wLjAuMA

Brinkmann, S., & Kvale, S. (2015). *Interviews. In Learning the Craft of Qualitative Research Interviewing*. Washington, DC: Sage Publications.

BS (2023). Bicibus Summit 2023. Retrieved from http://bikebussummit.org/#about

Buics, L., Süle, E., & Szalay, M. (2023). Sustainability of On-Demand Public Transportation from the Customer Perspective. *Chemical Engineering Transactions*, *107*, 427–432. https://doi.org/10.3303/CET23107072

Buttazzoni, A. N., Van Kesteren, E., Shah, T. I., & Gilliland, J. A. (2018). Active school travel intervention methodologies in North America: a systematic review. *American Journal of Preventive Medicine, 55*(1), 115–124. https://doi.org/10.1016/j.amepre.2018.04.007

CD (2023). A Civil Díj döntősei 2023 (Finalists of the Civic Awards 2023). Retrieved from https://civildij.hu/a-civil-dij-2023-dontosei/

Cradock, A. L., Fields, B., Barrett, J. L., & Melly, S. (2012). Program practices and demographic factors associated with federal funding for the Safe Routes to School program in the United States. *Health & Place, 18*(1), 16–23. https://doi.org/10.1016/j.healthplace.2011.08.015

Dias, C., Abdullah, M., Lovreglio, R., Sachchithanantham, S., Rekatheeban, M., & Sathyaprasad, I. M. S. (2022). Exploring home-to-school trip mode choices in Kandy, Sri Lanka. *Journal of Transport Geography*, *99*, 103279. https://doi.org/10.1016/j.jtrangeo.2022.103279

DiGuiseppi, C., Roberts, I., Li, L., & Allen, D. (1998). Determinants of car travel on daily journeys to school: cross sectional survey of primary school children. *BMJ*, *316*(7142), 1426–1428. https://doi.org/10.1136/bmj.316.7142.1426

EC (2023). Sustainable Urban Mobility. European Commission. Retrived from https://transport.ec.europa.eu/transport-themes/urban-transport/sustainable-urban-mobility_en

El-Dorghamy, A., & Mosa, A. I. (2016). Exploring children's travel to school in upgraded informal settlements: A qualitative case study of Ezbet El-Haggana. *Transportation Research Procedia*, *14*, 1277–1286. https://doi.org/10.1016/j.trpro.2016.05.200

Engwicht, D. (1992). *Towards an Eco-City: Calming the Traffic*. Sydney: Envirobook.

Faragó, B. (2024). Competitiveness indicators of sports cities in Eastern and Central Europe. *Theoretical and Empirical Researches in Urban Management*, 19(1), 30–53.

Gelencsér, M., Szabó-Szentgróti, G., Kőmüves, Z., & Hollósy-Vadász, G. (2023). The Holistic Model of Labour Retention: The Impact of Workplace Wellbeing Factors on Employee Retention. *Administrative Sciences*, *13*(5), 121–146. http://doi.org/10.3390/admsci13050121

HCC (2022). This is how Hungary cycles in 2022. Hungarian Cycling Club. Retrieved from

Heelan, K. A., Abbey, B., Donnelly, J., Mayo, M. S., & Welk, G. J. (2009). Evaluation of a walking school bus for promoting physical activity in youth. *Journal of Physical Activity and Health*, *6*(5), 560–567. https://doi.org/10.1123/jpah.6.5.560

Holstein, J.A., & Gubrium, J.F. (1995). *The Active Interview* (vol. 37). Thousand Oaks, CA: Sage.

HSO (2022a). School-age population by county and region. Retrieved from https://www.ksh.hu/stadat_files/okt/hu/okt0032.html

HSO (2022b). Population of Gödöllő. Retrieved from https://www.ksh.hu/apps/hntr.telepules?p_lang=HU&p_id=32559

HSO (2023a). The population of Hungary. Retrieved from https://www.ksh.hu/stadat_files/nep/hu/nep0034.html

HSO (2023b). Data about the Hungarian Education. Retrieved from https://www.ksh.hu/s/kiadvanyok/oktatasi-adatok-2022-2023-elozetes-adatok/index.html

Ikeda, E., Mavoa, S., Cavadino, A., Carroll, P., Hinckson, E., Witten, K., & Smith, M. (2020). Keeping kids safe for active travel to school: A mixed method examination of school policies and practices and children's school travel behaviour. *Travel behaviour and society*, *21*, 57–68. https://doi.org/10.1016/j.tbs.2020.05.008

Jones, M., Defever, E., Letsinger, A., Steele, J., & Mackintosh, K. A. (2020). A mixed-studies systematic review and meta-analysis of school-based interventions to promote physical activity and/or reduce sedentary time in children. *Journal of Sport and Health Science*, *9*(1), 3–17. https://doi.org/10.1016/j.jshs.2019.06.009

Karsten, L. (2005). It all used to be better? Different generations on continuity and change in urban children's daily use of space. *Children's Geographies*, *3*(3), 275–290, https://doi.org/10.1080/14733280500352912

Kaufmann, V., Bergman, M. M., & Joye, D. (2004). Motility: Mobility as capital. *International Journal of Urban and Regional Research*, *28*(4), 745–756. https://doi.org/10.1111/j.0309-1317.2004.00549.x

Kearns, R., Boyle, A., & Ergler, C. R. (2012). The legacy of an intervention: Exploring teenage walking school bus 'graduates' mobilities in Auckland. *Sites: A Journal of Social Anthropology and Cultural Studies, 9*(1), 83–106. https://doi.org/10.11157/sites-vol9iss1id190

Keller, V., & Ercsey, I. (2023). Analyzing Perspectives on Lifestyle M-Health Apps: User and Non-User Insights. In I. V., Pereira, P. B., Pires & J. D., Santos (Eds.). *Effective Digital Marketing for Improving Society Behavior Toward DEI and SDGs* (pp. 48–67). http://doi.org/10.4018/978-1-6684-8984-0.ch003

Kingham, S., & Ussher, S. (2005). Ticket to a sustainable future: an evaluation of the long-term durability of the Walking School Bus programme in Christchurch, New Zealand. *Transport Policy*, *12*(4), 314–323. https://doi.org/10.1016/j.tranpol.2005.05.002

Kingham, S., & Ussher, S. (2007). An assessment of the benefits of the walking school bus in Christchurch, New Zealand. *Transportation Research Part A: Policy and Practice*, *41*(6), 502–510. https://doi.org/10.1016/j.tra.2006.11.008.

Knox, P. L. (2005). Creating Ordinary Places: Slow Cities in a Fast World. *Journal of Urban Design*, *10*(1), 1–11. https://doi.org/10.1080/13574800500062221

Kong, A. S., Sussman, A. L., Negrete, S., Patterson, N., Mittleman, R., & Hough, R. (2009). Implementation of a Walking School Bus: Lessons Learned. *Journal of School Health*, *79*(7), 319–325. https://doi.org/10.1111/j.1746-1561.2009.00416.x

Kotsila, P., Anguelovski, I., García-Lamarca, M., & Sekulova, F. (2023). *Injustice in Urban Sustainability. Ten Core Drivers*. London: Routledge.

Kvale, S. (1996). *InterViews. An Introduction to Qualitative Research Interviewing*. Thousand Oaks, CA: Sage Publications.

Lewis, C. E., Ubido, J., Holford, R., & Scott-Samuel, A. (2010). Prevention programmes cost-effectiveness review: physical activity. Retrieved from: https://researchonline.ljmu.ac.uk/id/eprint/2004/1/83_28th_Feb_Physical_activity_and_cost_FINAL.pdf

Lieszkovszky, J. P., Hardi, T., & Ács, B. (2021). A vidéki térségek közforgalmú közlekedési hálózatának fejlődése Magyarországon a kezdetektől a XXI. század elejéig (Development of the public transport network of rural areas in Hungary from the roots until the beginning of the 21st century). *Tér és Társadalom*, *35*(2), 89–109. https://doi.org/10.17649/TET.35.2.3290

Lipták, K. (2019). The importance of social innovations in rural areas. *Deturope*, *11*(3), 160–174. https://doi.org/10.32725/det.2019.031

Mah, S. K., Nettlefold, L. A., Macdonald, H. M., Winters, M., Race, D., Voss, C., & McKay, H. A. (2017). Does parental support influence children's active school travel? *Preventive medicine reports*, *6*, 346–351. https://doi.org/10.1016/j.pmedr.2017.04.008

Maltese, I., Gatta, V., & Marcucci, E. (2021). Active travel in sustainable urban mobility plans. An Italian overview. *Research in Transportation Business & Management*, *40*, 100621. https://doi.org/10.1016/j.rtbm.2021.100621

Malucelli, F., Nonato, M., & Tresoldi, E. (2017). Optimization based planning of Pedibus lines: an arc based approach. *Transportation Research Procedia*, *27*, 760–767. https://doi.org/10.1016/j.trpro.2017.12.049

Malucelli, F., Tresoldi, E., & Nonato, M. (2018). Designing pedibus lines: a path based approach. *Electronic Notes in Discrete Mathematics*, *69*, 149–156. https://doi.org/10.1016/j.endm.2018.07.020

Mayer, H., & Knox, P. L. (2006). Slow cities: sustainable places in a fast world. *Journal of Urban Affairs, 28*(4), 321–334. https://doi.org/10.1111/j.1467-9906.2006.00298.x

McDonald, N. C., & Aalborg, A. E. (2009). Why Parents Drive Children to School: Implications for Safe Routes to School Programs. *Journal of the American Planning Association*, 75(3), 331–342. https://doi.org/10.1080/01944360902988794

Mendoza, J. A., Watson, K., Chen, T. A., Baranowski, T., Nicklas, T. A., Uscanga, D. K., & Hanfling, M. J. (2012). Impact of a pilot walking school bus intervention on children's pedestrian safety behaviors: A pilot study. *Health & Place*, *18*(1), 24–30. https://doi.org/10.1016/j.healthplace.2011.07.004

Mendoza, J. A., Haaland, W., Jacobs, M., Abbey-Lambertz, M., Miller, J., Salls, D., Todd, W., Madding, R., Ellis, K., & Kerr, J. (2017). Bicycle trains, cycling, and physical activity: a pilot cluster RCT. *American Journal of Preventive Medicine*, *53*(4), 481–489. https://doi.org/10.1016/j.amepre.2017.05.001

Migliore, M., D'Orso, G., & Capodici, A. E. (2021). The Go2School project for promoting cycling to school: A case study in Palermo. *Cleaner and Responsible Consumption*, *2*, 100019. https://doi.org/10.1016/j.clrc.2021.100019

Naef, P. J. (2017). Der Pedibus in der Schweiz: Nutzung, Bekanntheit und Wahrnehmung. *Mobilität mit Zukunft*, *1*, 1–32.

Nikitas, A., Wang, J. Y., & Knamiller, C. (2019). Exploring parental perceptions about school travel and walking school buses: A thematic analysis approach. *Transportation Research Part A: Policy and Practice*, *124*, 468–487. https://doi.org/10.1016/j.tra.2019.04.011

Pate, R. R., Flynn, J. I., & Dowda, M. (2016). Policies for promotion of physical activity and prevention of obesity in adolescence. *Journal of Exercise Science & Fitness, 14*(2), 47–53. https://doi.org/10.1016/j.jesf.2016.07.003

Pellicelli, G., Rossetti, S., Caselli, B., & Zazzi, M. (2022). Urban regeneration as an opportunity to redesign Sustainable Mobility. Experiences from the Emilia-Romagna Regional Call. *Transportation Research Procedia*, *60*, 576–583. https://doi.org/10.1016/j.trpro.2021.12.074

Pérez-Martín, P., Pedrós, G., Martínez-Jiménez, M. P., & Varo-Martínez, M. (2018). Evaluation of a walking school bus service as an intervention for a modal shift at a primary school in Spain. *Transport Policy*, *64*, 1–9. https://doi.org/10.1016/j.tranpol.2018.01.005

Petrini, C. (2013). *Slow food nation: Why our food should be good, clean, and fair*. Bra: Rizzoli Publications.

Pigalle, E. (2018). Distribution spatiale des Pédibus: une approche interactionniste environnement-famille. Les cas de Lausanne en Suisse et Aix-en-Provence en France. URBIA. *Les Cahiers du développement urbain durable*, *4*, 175–190.

Pirlone, F., & Spadaro, I. (2020). The resilient city and adapting to the health emergency. *TeMA-Journal of Land Use, Mobility and Environment*, 305–314. https://doi.org/10.6092/1970-9870/6856

Săgeată, R., Mitrică, B., Cercleux, A. L., Grigorescu, I., & Hardi, T. (2023). Deindustrialization, Tertiarization and Suburbanization in Central and Eastern Europe. Lessons Learned from Bucharest City, Romania. *Land, 12*, 1731. https://doi.org/10.3390/land12091731

Sahlqvist, S., Veitch, J., Abbott, G., Salmon, J., Garrard, J., Acker, F., Hartman, K., & Timperio, A. (2019). Impact of an Australian state-wide active travel campaign targeting primary schools. *Preventive Medicine Reports*, *14*, 100866. https://doi.org/10.1016/j.pmedr.2019.100866

Santinha, G., Dias, A., Rodrigues, M., Rodrigues, C., Bastardo, R., Pavão, J., & Pacheco Rocha, N. (2021). Smart Cities and Urban Logistics: A Systematic Review of the Literature. *Europa XXI*, *41*, 37–58. https://doi.org/10.7163/Eu21.2021.41.2

Smith, M., Ikeda, E., Duncan, S., Maddison, R., Hinckson, E., Meredith-Jones, K., Walker, C., & Mandic, S. (2019). Trends and measurement issues for active transportation in New Zealand's physical activity report cards for children and youth. *Journal of Transport & Health*, *15*, 100789. https://doi.org/10.1016/j.jth.2019.100789

Starikova, A. (2018). Population mobility in Bavaria: spatio-temporal features and migration flows in the early 21st century. *Europa XXI*, *34*, 59–78. https://doi.org/10.7163/Eu21.2018.34.4

Sul, J., Lee, J., Kang, D. S., Lee, W., Shim, J. I., Myeong, M., Huh, E., & Lim, J. K. (2015). *Korea's 95% Reduction in Child Traffic Fatalities: Policies and Achievements*. Sejongcity: The Korea Transport Institute.

Sunitiyoso, Y., Wicaksono, A., Pambudi, N. F., Rahayu, W. A., Nurdayat, I.F., Hadiansyah, F., Nuraeni, S., & Muhammad, A. A. (2023). Future of mobility in Jakarta Metropolitan Area: A Multi-Stakeholder scenario planning. *Transportation Research Interdisciplinary Perspectives*, *19*, 100810. https://doi.org/10.1016/j.trip.2023.100810

Ton, A. D., Hammerl, L., Weber, D., Kremer, O., & Szabo-Szentgroti, G. (2022). Why leaders are important for cross-functional teams: Moderating role of supportive leadership on knowledge hiding. *Problems and Perspectives in Management*, *20*(3), 178–191. http://doi.org/10.21511/ppm.20(3).2022.15

Tori, S., Te Boveldt, G., & Keseru, I. (2023). Building scenarios for urban mobility in 2030: The combination of cross-impact balance analysis with participatory stakeholder workshops. *Futures, 150*, 103160. https://doi.org/10.1016/j.futures.2023.103160

Urry, J. (2012). Social networks, mobile lives and social inequalities. *Journal of Transport Geography*, *21*, 24–30. https://doi.org/10.1016/j.jtrangeo.2011.10.003

Uszkai, A. (2016). Evaluation of Vienna's World Economic Position Based on Global and World City Rankings. *Deturope*, *8*(3), 72–87. https://www.deturope.eu/pdfs/det/2016/03/06.pdf

Vinkóczi, T., Heimné, R. É. & Koltai, J. P., (2023). Consumer Perception of the Zero-Waste Concept: a Hungarian Case Study. *Chemical Engineering Transactions*, 107, 355–360. https://doi.org/10.3303/CET23107060

Wati, K., & Tranter, P. J. (2015). Spatial and socio-demographic determinants of South East Queensland students' school cycling. *Journal of Transport Geography*, *47*, 23–36. https://doi.org/10.1016/j.jtrangeo.2015.07.005

Waygood, E., Owen, D., & Susilo, Y. O. (2015). Walking to school in Scotland: Do perceptions of neighbourhood quality matter? *IATSS research*, *38*(2), 125–129. https://doi.org/10.1016/j.iatssr.2014.12.002

Waygood, E., Owen, D., & Taniguchi, A. (2020). Japan: maintaining high levels of walking. *Transport and Children's Wellbeing*, 297–316. https://doi.org/10.1016/B978-0-12-814694-1.00016-6

Waygood, E., Owen, D., Craig-St-Louis, C., & Xu, X. (2015). International origins of walking school buses and child fatalities in Japan and Canada. *Traffic science*, *46*(2), 30–42.

WHO (2021). 2021 Physical activity factsheets for the European Union member states ain the WHO European Region. World Health Organization. Retrieved from https://sport.ec.europa.eu/document/europe-physical-activity-factsheet-2021

WHO (2022a). WHO European Regional Obesity Report 2022. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/353747/9789289057738-eng.pdf
WHO (2022b). Promoting physical activity through schools: policy brief. Retrieved from https://www.who.int/publications/i/item/9789240049567
Zadęcka, E. (2018). „Slow city" as a local development model. *Economic and Regional Studies*, *11*(30), 84–106. https://doi.org/10.2478/ers-2018-0027

Appendix 1. Interview questions

1. Please describe the bicibus/pedibus program (who is the target audience, who are the organizers and chaperones, how regularly does the program run, how many schools and how many people have been involved, etc.)
2. What international example has served as a model for the program?
3. How many schools have been involved in the program? How open are the schools to being approached?
4. Could you evaluate the initiative of the program and its strengths, weaknesses, opportunities, and threats?
5. What are your plans for the future? Are there plans to include digital tools in the program? E.g., own app, reducing administration, similar to the Barcelona bus app?
6. Are you thinking of creating a national network? Would you be involved in the network developed by the program?
7. Barcelona 2023 hosted a Bicibus Summit with experts worldwide to exchange ideas and experiences. Do you plan to participate in similar forums? (http://bikebussummit.org/)