Reshaping travel behaviour: how to overcome the “commuting paradox”?

Tamás, Kaiser
Department of Governance Studies and Public Service, University of Public Service
kaiser.tamas@uni-nke.hu

ABSTRACT

Recently the continually emerging internet and mobile revolution has had a fundamental societal impact which ultimately changed the ways, modes and devices of communication and mobility. Advances of internet platforms, smartphone and tablet applications, and the rise of social media platforms are becoming increasingly relevant in transport contexts. This paper addresses the need for avoiding the phenomena of the "the commuting paradox," among which the travel-based multitasking could be a crucial opportunity. Based on a representative survey in March-April 2020 Hungary in order to identify the factors, attitudes and demands that influence the use of smart devices during frequent commuting the paper argues that the implementation of travel-based multitasking is influenced by a number of factors, of which labour market status and attitudes towards the adoption of new technologies are of key importance.

CCS CONCEPTS

• ; • **User studies**; • **Sociology**; • **Interactive systems and tools**;

KEYWORDS

Smart devices, Commuting, Commuting paradox, Multitasking, Attitudes

ACM Reference Format:
Tamás, Kaiser. 2023. Reshaping travel behaviour: how to overcome the “commuting paradox”?. In *Central and Eastern European eDem and eGov Days 2023 (CEEeGov 2023), September 14, 15, 2023, Budapest, Hungary*. ACM, New York, NY, USA, 8 pages. https://doi.org/10.1145/3603304.3605914

1 INTRODUCTION

Recently the advances of internet platforms, smartphones and tablet applications as well as the rise of social media platforms have been increasingly relevant in transport contexts. They facilitate travel, provide new communication patterns for travellers, widen their transport mode choices as well as create new transport demands. [4, 7, 9, 18] Due to the spread of mobile and smart communication technologies over the past twenty years it is crucial to understand the multifaceted issue of travel behaviour in general and the changing nature of the day-to-day process of commuting all over the world in particular.

CEEeGov 2023, September 14, 15, 2023, Budapest, Hungary

ACM ISBN 979-8-4007-0006-4/23/09…$15.00
https://doi.org/10.1145/3603304.3605914

From this angle, it makes sense to examine why certain groups of people undertake longer commutes when that day-to-day activity produces both positive and negative feelings. Commuting takes time, creates stress, is expensive, negatively impacts our happiness and has been shown to negatively affect health and family life. In contrast, it is compensated by better employment opportunity or a better living environment in spite of the longer commuting time that is systematically linked to worse subjective well-being outcomes. [15, 17, 19] However, this equilibrium is exposed to many unforeseen circumstances that can easily lead to trade-off effects between different life domains (personal life, leisure time) and thus bring net disutility. More specifically, if equilibrium is achieved, a positive impact of commuting can be expected, while disequilibrium persists, it is considered a “commuting paradox”. In order to keep balance between the two poles, the compensation argument suggests that there are opportunities to offset the negative consequences of trade-off effects or at least adapt to them in a case of incomplete compensation [3, 8]. Importantly, the rapid uptake of smartphones and other smart devices adds new value to physical presence in the form of multitasking by which travel time becomes more relaxing and productive. [10, 12, 16] However, the potential success of overcoming the “commuting paradox” depends on specific contextual factors. Firstly, within the commuting many groups can be conventionally distinguished, as non-commuters, business commuters and private commuters (employees) or from a narrower angle work-oriented commuters and others are identified. Secondly, the extent of commuting-related demands and satisfaction is determined by many factors as social-demographic endowments, individual attitudes, travel choices, duration of travel time, changes in life circumstances and job-related characteristics. [2, 5, 6, 19] Moreover, it has be also taken into account, that not all commuters spend their travel time in engaging productive activities which requires to add further criteria to the categories previously used. In doing so the “commuting paradox” is a complex problem with multiple possible causes and negative consequences if not addressed in a proper way.

The paper builds on the assumption that under certain preconditions, the negative effects and consequences of the “commuting paradox” can be avoided or at least compensated. In doing so, the activity-based travel time use has a crucial role with special regard to the acceptance, usage behaviour and attitudes of commuters towards smart devices. It highlights the importance of the mediating role of objective and subjective factors within the context of different life domains.

As a starting point, it can be made a difference between two extreme segments of citizens, namely the technophile and the technophobe clusters. In order to explore the drivers and implications both of these attitudes, the aim of the paper is to identify the background

of the correlations between the frequency of commuting, place of residence, and labor market status with Internet use, and to compare the attitudes of certain groups of commuters to digital technologies. These evidence-based findings show a significant association between ICT-based travel multi-tasking and travel behaviour.

In doing so two basic research questions will be answered. Firstly, what kind of factors influence the knowledge and intensity of the use of smart devices during frequent commuting. Secondly, the extent to which attitudes to digital technologies are influenced by the type and context of commuting will be considered.

Based on this, the hypothesis of the paper claims that the high intensity of internet use among regular commuters is closely linked to the development of a positive attitude towards digital technologies which is an essential precondition of overcoming the "commuting paradox".

To test it in an empirical way in a case of Hungary a representative survey on citizen's perceptions (N=2300) was created and administered in order to explore the overall set of variables that affect the elements and their interference.

2 THEORETICAL AND METHODOLOGICAL FRAMEWORKS

Over the last several decades a large number of theoretical models have been developed and used to explore ICT acceptance and usage. The various technological models seeks to explain the intention of individuals and groups to accept and use ICT technology. These include among others the Social Construction of Technology (SCOT), the Innovation Diffusion of Theory (DT), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Unified Model of Electronic Government Adoption (UMEGA). [1, 6, 13, 19, 20] These theories offer different interpretative frameworks of ICT acceptance and usage behaviour based on different factors such as stages of technological development, attitudes of individuals and user groups as well as other contextual elements [21, 22].

According to the research questions of the paper, we highlight the usefulness of the Diffusion of Innovation (DOI). The theory, which was introduced by Everett M. Rogers comprises two overarching topics: the first is the variables that influence the diffusion process and the second is the evaluation process that the receivers of the innovation go through. [14] As a matter of the influencing variables, Rogers identifies five elements that impact the diffusion of new technologies which are (1) innovation (2) adopters, (3) communication channels (4) time (5) social system. Communication through various channels and forms plays a crucial role in every single step of the mechanism. The evaluation process leads adopters to either accept or reject the respective innovation. The process by which a person adopts an innovation includes five steps, such as (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. The progress of adopting an innovation does not happen simultaneously, there are some people who are quicker to adopt while others are rather slow. Therefore, Rogers established adopter categories such as (1) innovators, (2) early (3) adopters, (4) early majority, (5) late majority, and (6) laggards.

The DOI has proven to be a useful tool to understand the drivers of the general innovation process across multiple disciplines, regardless of its cultural or societal system (Atkin et al., 2015). The critics against DOI highlight that adoption of innovation is always desirable (normative), it tends not to evaluate innovations from an end-user perspective. Further, there are few systematic evaluations of the adoption and diffusion model, research on model does not tend to focus on systemic change (changes to the social system), rather the focus is on discrete technical changes, changes by individuals and groups rather than institutions and societies as a political project.

Data on which the analysis is based on 'The image and perception of public administration among the population' data collection conducted in Hungary March and April 2020. The representative questionnaire used in the research included a section related to the use of smart devices. The survey reached 2500 respondents by TAPI (Tablet Assisted Personal Interviewing) is representative of gender, age, place of residence and education among the population over the age of 18 having address in Hungary. As part of the comprehensive survey, the so-called 'Smart city' questionnaires were used with half of the sample, i.e. 1,250 people, which is representative in itself. The addresses of those involved in the research were selected by multi-stage, proportionally layered, probabilistic sampling. The data were collected in face-to-face interviews at the address of the respondents. In view of the COVID19 epidemic, the company conducting the survey provided the opportunity to respond by telephone following a personal request for participation, which was used by 76% of the respondents. The thematic section of 13 questions in the questionnaire related to the smart city addressed the following topics: perceptions related to the smart city, use of devices and applications related to transport, travel and entertainment, technophobic-technophilic attitudes, opinions on specific municipal 'smart solutions' The detailed data desription of the survey was published by Kaiser-Gadár [11].

During the analysis of the results, a dual goal was defined: to create groups based on the knowledge and use of smart devices and solutions, and to show the relationship among the attributes of respondents (age, place of residence, type of residence, education, income, mode of transport, internet use, innovation). Among the factors, we focused mainly on commuting, while also gaining a better understanding of the characteristics and attitudes of commuters.

3 RESULTS

Relating to the "smart city" thematic section of the questionnaire one filter question was taken in relation to the type of residence of the respondents: only respondents who do not live in Budapest capital or any county seat were asked how many times in an average month they travel to the capital. and any county seat or district centre. Based on this, we aggregated the answers to the three questions and created a commuting variable (Figure 1). Respondents who made 0 trips were classified as immobile. Those who travel only a few times a month (1-8 times) were placed in the non-commuters category, those who commuted 9-15 times a month were placed in the infrequent commuters category, and those who commuted more than this were placed in the commuters category.

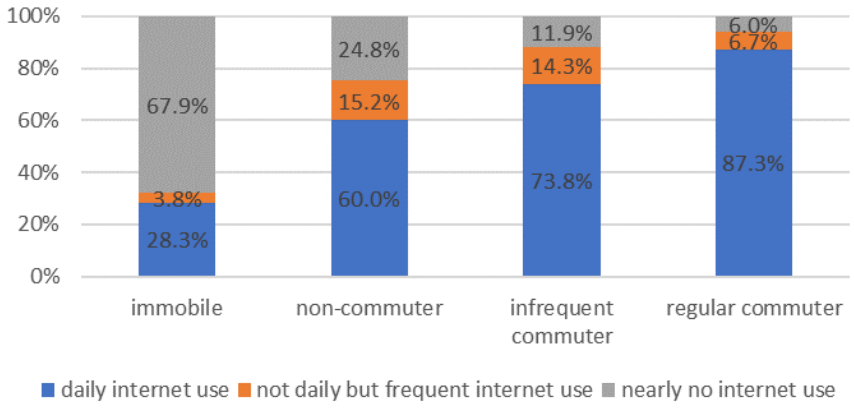

Figure 1: Correlation of commuting with internet use (N=754)

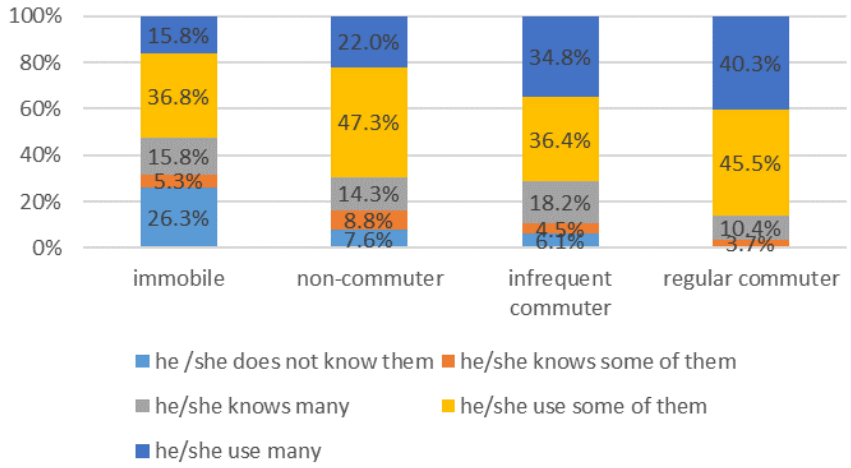

Figure 2: Relationship of commuting to travel-related application use (variables k83 and k86) (N=547

The correlation clearly shows that the more often someone commutes, the more they use the internet. 87.3% of regular commuters use the internet every day, while this statement is true only for 28.3% of immobile people (Figure 2). We then examined our commute frequency variable with our previously created travel-related application usage variable. Travel-related applications examined in the survey: online maps, route planner, electronic tickets on public transport, carpooling services, shared transport, purchase of digital parking tickets [11]. The strength of the correlation can be characterized by a Cramer's V of 0.163.

As a result, regular commuters know and use the mobile phone applications and internet options related to the travel that appear in the questionnaire. [11] Among them, users who use the most have the highest proportion (40.3%), a quarter of immobile ones (26.3%) do not know these applications at all.

Since we did not ask questions about commuting to people living in the capital and the county seat, we created a variable that includes both them and commuters. We have found that commuters have a higher proportion of internet users on a daily basis, compared even to those who live in the capital and county seats. Among commuters (Figure 3), the proportion of internet users on a daily basis is 82.5%, while for those living in the capital it is 70.0% and for those living in the county seat this proportion is 71.6%. Among non-commuters, the proportion of those who almost never use the internet is the highest (29.4%).

However, we modified the variable created above, based on its relationships with background variables: the real dividing line is not whether someone lives in the capital or county seat and, and on the other hand, someone is a commuter, but whether the respondent who lives in the capital or county seat has a job or student status. So, whether or not you are active according to your labour market status. That's why we created another variable (Figure 4).

It is clear that the group of regular commuters and those in the metropolitan workplace/students are really close. Interestingly, in the average age, the immobile and the inactive ones living in a big

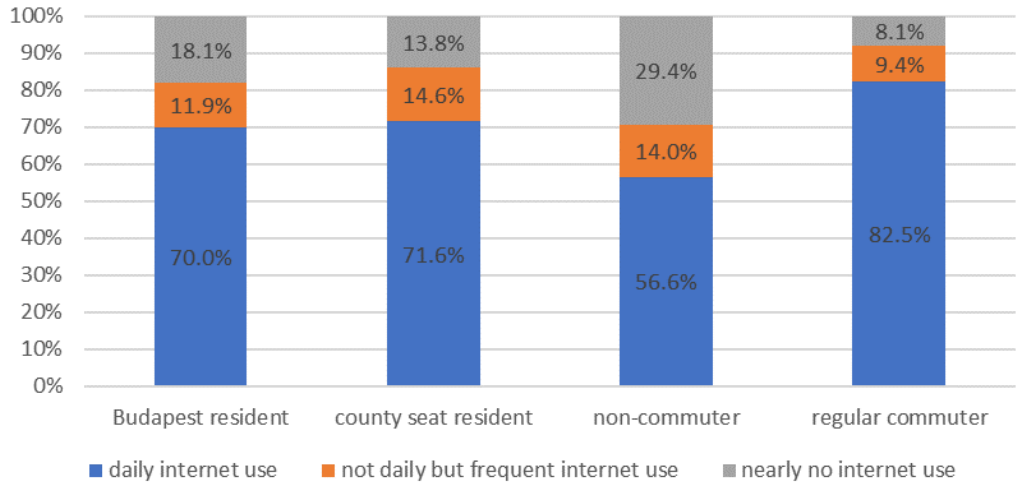

Figure 3: Correlation between place of residence and commuting with internet use (N=1747)

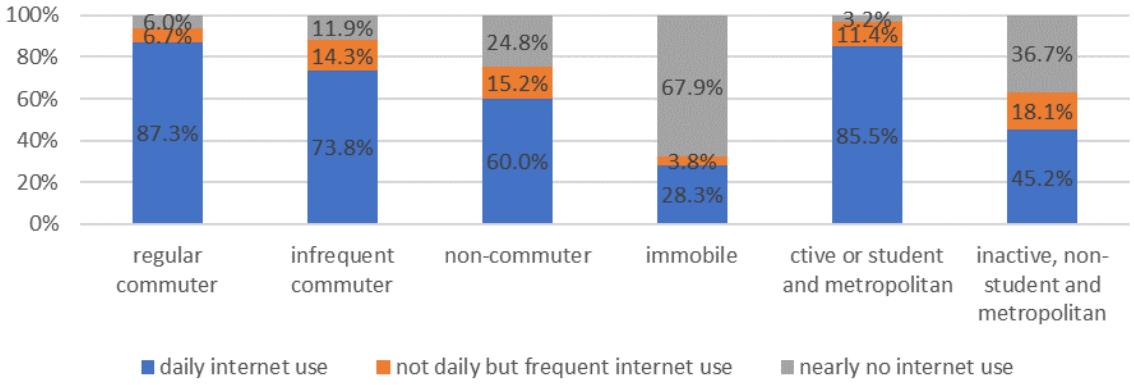

Figure 4: Relationship between place of residence, labour market status, commuting and internet use (N=1237)

city are the same, yet the inactive respondents living in the big city can be characterized by more favourable internet habits.

Knowledge of travel-related phone applications and websites is similar, among commuters those who use these applications a lot have the highest proportion (38.1%) and the lowest proportion of those who are unfamiliar with them (2.0%). Among non-commuters, the proportion of those who do not know these applications or websites is the highest (8.4%), and the proportion of use and knowledge of those living in Budapest and the county seat is a few percentage points lower than that of commuters (Figure 5).

If we look at the same variable with our variable extended by labour market status, we can see similar trends: regular commuters most closely resemble the metropolitan labour market active group. The group of inactive and immobile people use nearly the same number of applications, with a higher proportion of metropolitan inactive people who have at least heard of these but have not tried them yet (Figure 6).

The commute variable also shows a correlation with the variable created based on the time of connection to digital and computer culture. According to the often cited categories of Everett Rogers, the vast majority of immobile ones (68.5%) can be classified as digitally lagging behind, with only 11.1% being early adapters and 7.4% belonging to the early majority. According to Everett Rogers, five key variables that are influential elements in the process of diffusion of an idea and/or technology: innovation, adopters, communication channels, time and social system. As a matter of adopter characteristics, it includes variables such age, social status, education, and attitude towards risk. In contrast, only 5.5% of regular commuters are lagging behind, of which 29.0% are early adapters and innovators and 41.4% are early majority (Figure 7).

Finally, we also analysed the relationship with our principal component variable generated from technophilic and technophobic statements, which also showed a significant correlation with commuting (Table 1).

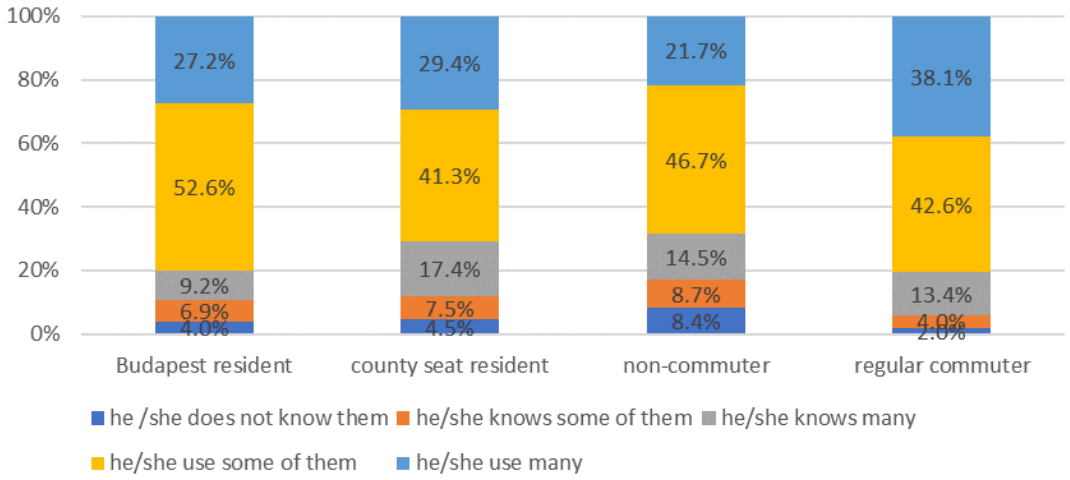

Figure 5: Correlation between place of residence and commuting with knowledge and use of travel-related applications (N=921)

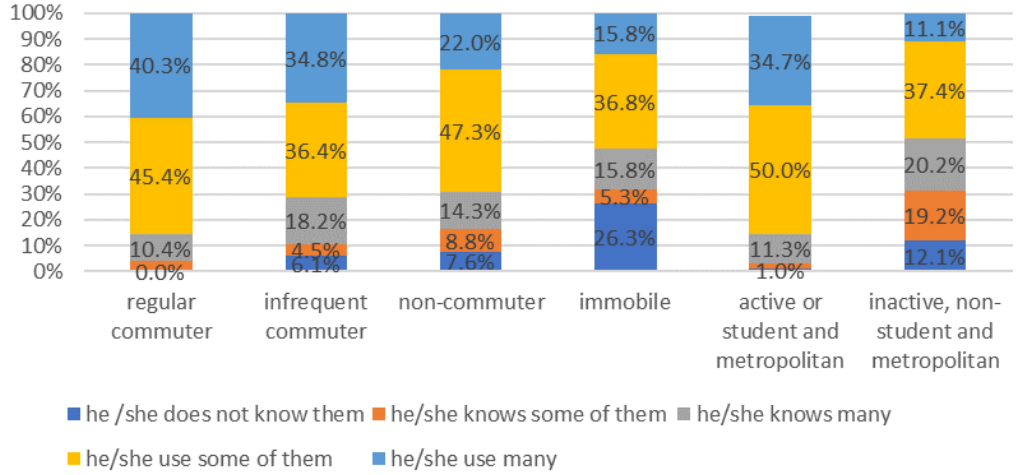

Figure 6: Relationship between place of residence, labour market status and commuting with knowledge and use of travel-related applications (N=920)

Table 1: Technophobe and technophile attitudes among commuters

	The main component of the interviewer's attitude related to following and innovating the technology: + technophilic, - technophobic
They are easy to use for me.	-.813**
It is a nuisance that knowledge of a foreign language is often required to use them.	.524**
I can save a lot by using them.	-.617 **
I don't have time to learn how to use them.	.321**
I can't turn to anyone for help when using them.	.434**
I can do a lot of things with them comfortably.	-.701**
I like having smart solutions that are fun at the same time.	-.594**

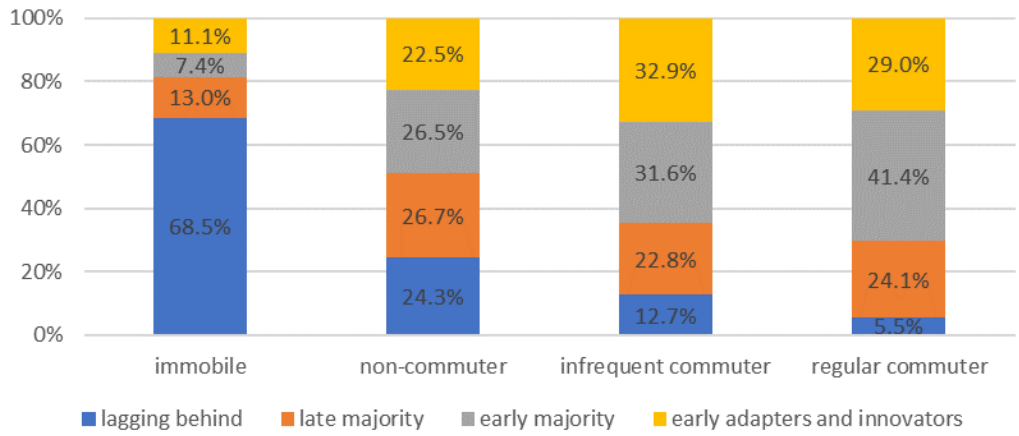

Figure 7: Relationship between digital and computer culture and commuting (N=727)

Table 2: Correlation of commuting with technophobic-technophilic statements (N=700)

Type of commuting	Score on a technophilic-technophobic scale
Immobile	-0.8179
Non-commuter	-0.1316
Infrequent commuter	0.1813
Regular commuter	0.4788

It is clear from the correlation table that the responses to positive, beneficial statements about smart solutions move with technophilic values, and vice versa for technophobic values. Overall, therefore, their created principal component fits well with attitude-type questions. Correlation of commuting (Table 2) with technophobic-technophilic statements (N=700, N=1146).

The scale scores show that immobile ones and non-commuters are on the technophobic side of the scale, while infrequent commuters and regular commuters are on the technophilic side of the scale (Table 3). (The higher the scale value, the more technophilic the respondent.)

Based on our other variable, we can see the surprising result that the most technophobic are the immobile ones, followed by the metropolitan inactive and then the non-commuters. The most technophilic are the regular commuters, followed by the metropolitan actives. Infrequent commuters are still on the technophile side of the scale, but their scale scores are very low.

The correlations observed so far are confirmed by the fact that our variables on commuting with labour market status and place of residence are also associated with the internet intensity index (Table 4).

Scores show that active city dwellers use the internet most frequently and intensively, followed by regular commuters with similarly high scores. Similar scores were given to those who commute infrequently, those who commute little and those in immobile status. On the basis of the internet usage intensity index, the obvious laggards are respondents without a job in a large city.

4 DISCUSSION

Commuting is based on equilibrium between positive and negative feelings or perceptions from the viewpoint of both individuals and households. If the balance between the two poles is broken due to the shift in negative direction, various compensation mechanisms are required in order to avoid the “commuting paradox” even if commuters are often willing to carry higher burdens than non-commuters.

The presumption of this paper claims that the lack of time characterises commuters most which enhances the need to spend travel

Table 3: Correlation of commuting with technophobic-technophilic statements, version 2 (N=1146)

Place of residence, labour market status and type of commuting	Score on a technophilic-technophobic scale
regular commuter	0.4788
infrequent commuter	0.1813
non-commuter	-0.1316
immobile	-0.8179
active or student and metropolitan	0.3557
inactive, non-student and metropolitan	-0.6823

Table 4: Correlation between place of residence, labour market status, and commuting with the internet usage intensity index (N=994)

Place of residence, labour market status and type of commuting	Internet usage intensity index score
regular commuter	21.04
infrequent commuter	18.58
non-commuter	17.83
immobile	18.21
active or student and metropolitan	21.22
inactive, non-student and metropolitan	14.32

time productively. High intensity and productive usage of Internet characterize regular commuters, which closely linked to the development of a positive attitude towards digital technologies. Smartphones and other smart devices can help rural commuters and urban residents to improve their quality of travel time with better spaces for working and communicating as well as affecting travellers' attitudes and expectations to the means of future smart developments. Commuters have definitely active lifestyles, and it is their vital interest to do administrative cases efficiently. Using other (public) service providers' out-of-office administration can help them save time if they have the devices and skills to use features.

The empirical evidences, based on the questionnaire survey on citizen's perceptions conducted in Hungary in March and April 2020 confirmed that perfect jobs and enjoyable living environment as the basic elements of the commuting equilibrium should be completed with further life domains and the related activities. Previous researches reported that the rapid proliferation of smart mobile devices established the conditions of the productive time use in the form of travel-based multitasking. Accordingly, we presumed that the activity-based travel time has become one of the main elements of the compensation mechanisms beside the conventional pillars. The usage of smart devices, for longer work commutes, social and entertainment activities either increase positive effects or counteract stress and boredom. Engagement in activities during travel may make the trips more pleasant and productive – at least in general terms. However, the results of the survey clearly show that the productive usage of smart devices for commuters rely on a number of pre-conditions. In this sense, we took the frequency of internet use as a point of departure which was extended with additional variables as the place of residence, the labour market status. as well as the use of travel-related applications. The first correlation clearly indicated, that the more often someone commutes, the more they use the internet. Based on this, the regularity of commuting in rural areas as well as the active educational and employment status in cities show a more positive, technophile attitude to new ICT and mobile technologies. These factors fundamentally affect and accelerate the rate of diffusion of technological innovations. In conclusion, the common denominator between the two technophile groups is the active employment status as well as skill endowments for productive travel time use and travel-based multitasking. Smartphones and other smart devices help rural commuters and urban residents to improve their quality of travel time with better spaces for working and communicating as well as affecting travellers' attitudes and expectations to the means of future smart developments.

We suggest that future empirical research can take into consideration this paper's theoretical contribution. For instance, relaying on the Technological Acceptance Model (TAM), two key domains should be involved to measure attitude toward technology acceptance and adoption in multiple domains, namely the 'perceived usefulness' and the 'perceived ease of use'. According to the TAM, the easier a technology to use and the more useful it is perceived to be, the more positive attitudes toward smart developments will be created.

Additionally, from the point of view of labour market needs, it would be crucial to explore whether the compensation for the physical and mental burdens occurred, to what extent and under which conditions as work-related commuting is one of the main factors most likely to affect individual well-being and performance.

Finally, as the equilibrium framework theory can only partly help us to better understand the nature of the "commuting paradox", a large number of mediating factors and other facilitating conditions have to be involved into the examination in order to properly assess whether the compensation for the physical and mental burdens occurred, to what extent and under which conditions. It is important to realize, that the costs and benefits of commuting in itself are rather elastic, which require a thorough analysis within different groups and communities.

ACKNOWLEDGMENTS

„TKP2021-NKTA-51 has been implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, financed under the TKP2021-NKTA funding scheme."

REFERENCES

[1] Bednar, Peter M, Welch, Christine. 2020. Socio-Technical Perspectives on Smart Working: Creating Meaningful and Sustainable Systems. Information Systems Frontiers. 22. 281-298. DOI: https://doi.org/10.1007/s10796-019-09921-1

[2] Chatterjee, Kiron, Chng, Samuel, Clark, Ben, Davis Adriam De Vos, Jonas, Ettema, Dick, Handy, Susan, Martin, Adam, and Reardon, Louise. 2020. Commuting and wellbeing: a critical overview of the literature with implications for policy and future research. Transport Reviews.Vol. 40. No. 1. 5-34. https://doi.org/10.1080/01441647.2019.1649317

[3] Choia, Sungtaek, Mokhtarian, Patricia L. 2020. How attractive is it to use the internet while commuting? A work-attitude-based segmentation of Northern California commuters. Transportation Research Part A, 138. 37–50. https://doi.org/10.1016/j.tra.2020.05.007

[4] Clark, Ben, Chatterjee Kiron, Martin, Adam and Davis, Adrian. 2020. How commuting affects subjective wellbeing. Transportation. 47:2777–2805. DOI: https://doi.org/10.1007/s11116-019-09983

[5] Csath, Magdolna, Fási, Csaba, Nagy, Balázs, Pálfi, Nóra, Taksás, Balázs, Vinogradov, Sergey. 2018. Measuring the Social Trust of Young People in the Light of

Competitiveness – a Case Study in Hungary. Vadyba/Journal of Management. 1.32. 49-59.

[6] Dwivedi, Yogesh Kumar, Rana, Nipendra P., Janssen, Marijn, Lal Banita., Williams, Michael D., and Clement, Marc. 2017. An empirical validation of a unified model of electronic government adoption (UMEGA). Government Information Quarterly. 34. 2. 211-230. doi:10.1016/j.giq.2017.03.001

[7] Elle, Marten, Dammann Sven, Lentsch Justus and Hansen Klaus. 2010. Learning from the social construction of environment indicators: From the retrospective to the pro-active use of SCOT in technology development. Building and Environment. 45. 1. 135-142. https://doi.org/10.1016/j.buildenv.2009.05.011

[8] Ettema, Dick, Friman, Margareta, Gärling, Tommy, Olsson, Lars E., Fujii, Satoshi. 2012. How in-vehicle activities affect work commuters' satisfaction with public transport. Journal of Transport Geography. 24. 215–222. https://doi.org/10.1016/j.jtrangeo.2012.02.007

[9] Gerber, Philippe Thériault, Marius, Enaux, Christophe and Carpentier-Postel, Samuel. 2020. Links between Attitudes, Mode Choice, and Travel Satisfaction: A Cross-Border Long-Commute Case Study. Sustainability. 12. 21. 9203 https://doi.org/10.3390/su12219203

[10] Jang, Jaemin and Ko, Joonho. 2019. Factors associated with commuter satisfaction across travel time ranges. Transportation Research Part F. 66. 393–405. https://doi.org/10.1016/j.trf.2019.09.019

[11] Julsrud, Tom E and Denstadli, John M. 2017. Smartphones, travel time-use and attitudes to public transport services. Insights from an explorative study of urban dwellers in two Norwegian cities. International Journal of Sustainable Transportation. 11. 8. 602-610. https://doi.org/10.1080/15568318.2017.1292373

[12] Kaiser, Tamás and Gadár, László. 2023. Survey data on the attitudes towards digital technologies and the way of managing e-governmental tasks. Data in Brief. 46. February 2023, 108871, https://doi.org/10.1016/j.dib.2022.108871

[13] Ma, Ling, Ye, Runing. 2019. Does daily commuting behavior matter to employee productivity? Journal of Transport Geography. 76. 130–141. https://doi.org/10.1016/j.jtrangeo.2019.03.008

[14] Mensah, Isaac K, Zeng, Guohua, and Luo, Chuoanyong. 2020. E-Government Services Adoption: An Extension of the Unified Model of Electronic Government Adoption. SAGE Open. April-June, 1-17. https://doi.org/10.1177/215824402093

[15] Rogers, Everett M. 1983. Diffusion of Innovations. Third Edition. The Free Press. A Division of Macmillan Publishing Co., Inc. New York, Collier Macmillan Publishers, London

[16] Simón, Hipólito, José M. Casado-Díaz &Adelaida Lillo-Bañuls. 2020. Exploring the effects of commuting on workers'satisfaction. Regional Studies. 54. 4. 550-562. https://doi.org/10.1080/00343404.2018.1542128

[17] Singleton, Patrick A. 2018. How Useful is Travel-Based Multitasking? Evidence from Commuters in Portland, Oregon. Transportation Research Record. 2672. 50. 11–22. https://doi.org/10.1177/0361198118776151

[18] Stutzer, Alois, Frey, Bruno S. 2008. Stress that Doesn't Pay: The Commuting Paradox. Scand. J. of Economics. 110. 2. 399-366.

[19] Tóth, Tibor. 2018. Az európai szociális modell történeti változásai és perspektívái (The historical changes and perspectives of the European social model). Európai Tükör. 21. 2. 33-50.

[20] Ye, Runing and Titheridge, Helena. 2017. Satisfaction with the commute: The role of travel mode choice, built environment and attitudes. Transportation Research Part D: Transport and Environment. 52. (B). 535-547. https://doi.org/10.1016/j.trd.2016.06.011

[21] Venkatesh, Viswanath, Morris, Michael G., Davis, Gordon B., and Davis, Fred D. 2003. User acceptance of information technology: Toward a unified view. MIS Quarterly. 27. 3. 425-478. https://doi.org/10.2307/30036540

[22] Venkatesh, Viswanath, Thong, James Y., and Xu, Xin. 2016. Unified theory of acceptance and use of technology: A synthesis and the road ahead. Journal of the Association for Information Systems. 17. 5 328-376. https://doi.org/10.17705/1jais.00428