

Travel-based Multitasking on the Budapest Metro

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Abstract: Nowadays, travel-based multitasking is a thoroughly studied area, especially regarding the daily commuting and longer work-related trips. We already examined travel-based multitasking in a busy urban environment based on a data collection in 2019, focusing on the metro as a main mode of transportation—these results were presented at the 10th International Conference on Transportation Sciences in Győr, 2020. In 2023, another survey was conducted with basically the same methodology. The aim in both cases was to reveal characteristics of travel-based multitasking, taking societal factors (e.g., age, gender) and travel-specific characteristics (e.g., crowding, journey length) into account—but the latter data collection provides an opportunity to assess the effects of the past four years, including the potential impact of digitalization, the prevalence of flexible work hours, remote work, or home office also. Descriptive statistical tools were used for the analysis, with the aim of identifying the differences and similarities between the two datasets, comparing the change of various activity groups' shares in the sample, and calculating the proportions of activities in different age and social groups, journey length, etc. Our paper focuses on the Budapest metro, examining and comparing the passengers' activities in 2019 and 2023.

Keywords: *travel-based multitasking; structured observation; Budapest metro; travel characteristics; digitalization; descriptive statistics; activity groups*

Introduction

Economic development in the 20th century, especially in urban areas led to the growth of cities and the rapid growth in the share of motorised transport modes. Cities and their hinterlands expanded, increasing travel distances associated with daily commuting. While the duration of daily commutes allowed the productive use of travel time, the accessible activities remained on a relatively simple level because of technological constraints (e.g., reading, having a conversation).

A significant enhancement to the expansion of activities conducted during travel became possible with the rapid development of info- and telecommunication technologies (ICT) and mobile devices, along with the corresponding surge in related services, particularly those associated with wireless access to the internet. This development facilitated communication with individuals outside the vehicle, enabled the integration of various types of work, leisure, and entertainment activities into daily travel routines. Ultimately, the innovations in ICTs introduced a wide range of work forms into public consciousness, by enabling effective work during travel. These activities can mostly be carried out on public transport vehicles, as the use of individual mobility devices typically limits the range of activities due to the greater concentration required for driving.

Contrary to the perception of travel as wasted time, scientific literature demonstrates the utility and value of travel time from the perspectives of passengers, employers, and the economy [1, 2]. The study of activities conducted during travel—or travel-based multitasking in scientific terms—has a long history, but targeted studies became more widespread in the early 2000s, after the proliferation of ICTs [3–7].

Based on two structured observations four years apart, our research examines the characteristics of travel-based multitasking, according to social attributes (observed age, gender, etc.) and features of travel (e.g., duration). Additionally, the two measurements allow the comparison of results, revealing

the potential effects of further digitization, changes in travel habits, and the COVID–19 pandemic that occurred between them.

In the first chapter, the background and the importance of travel-based multitasking is introduced, along with the definitions applied in the study. Afterwards, the methodology of data collection and analysis will be presented, followed by the detailed results. The article will conclude with the drawn conclusions.

1. Scope of travel-based multitasking

The delineation of travel-based multitasking is already well-characterized by the phrase itself, meaning activities carried out alongside the essential, primary activity of travel. There is no consensus in the literature regarding the definition of “multitasking” [8], so the essence of the definition used in this study comes from the phrase itself, indicating the engagement in multiple activities or tasks, either simultaneously or in rapid succession. Our study, like to the analysis of Keserű and Macharis [9], is based on the premise that traveling itself is an activity, so any additional activities performed during the trip result in multitasking.

The scope of activities that can be conducted during travel has expanded significantly over the past two decades. This is primarily attributed to advancements in technology, changes in lifestyle, and significant shifts in travel habits [9]. Previous studies have examined the subject qualitatively (analysing interviews, oral surveys, etc.) and quantitatively also. Quantitative studies analyse travel-based multitasking through measurements, stated preference surveys, observations, and other methods of examining traveller decisions and revealing travel preferences. Such analyses provide insights into passenger satisfaction [10–13], the valuation of travel time [2, 7, 14, 15], and the types and frequency of travel-based multitasking, which can be crucial inputs for vehicle, travel, and service planning [16–18], for instance, through vehicle equipment facilitating typical activities or by providing sufficient service avoiding excessive crowding.

Built on a household survey conducted in 2016, a study aimed to explore travel-based multitasking in Hungary, applying cluster analysis to categorize travellers using public transportation [19]. A similar study, focusing on travel-based multitasking concluded that nearly half of the activities could be deduced from the socio-economic characteristics of passengers or drivers [20]. The current study evaluates activities in a similar way to these previous ones.

Activities can be divided into two main groups according to whether they require only passive involvement (e.g., resting, relaxation) or active mental or physical effort from the individual (e.g., work, studying, reading). Additionally, travel itself can be considered as active or passive activity, depending on whether the individual is driving the vehicle or simply using it as a passenger [9, 21, 22]. In our study, since the target area is public transportation, travel is considered as a passive activity. Travel-based multitasking were thoroughly examined by Munkácsy et al. in 2020, resulting in the compilation of an “inventory of activities” that can be practiced while using certain modes of transport [23]. Partly based on these findings, a survey was conducted on the Budapest metro in 2019 [24], which served as the basis for the 2023 survey as well as the current study. See Chapter 2 for details of methodology.

In our study, numerous activities and activity groups were defined and examined, ranging from activities with a clear financial purpose such as work-related tasks (e.g., writing emails, reading notes, answering work-related phone calls), to activities aimed at relaxation and entertainment (watching videos, using social media, etc.). Evaluating the benefits of individual activities—whether at the individual’s or societal level—may reveal differences, but besides work-related tasks, activities serving relaxation purposes (e.g., window-gazing, relaxation) can also carry significant benefits, primarily for the passenger [9, 25]. These activities should not be considered a waste of time. The activity groups included in the study and the activities sorted in these categories can be summarized as follows: work-related activities (reading e-mails, working); studying; reading (newspapers, books, e-books, etc.); listening to music or radio; browsing online, playing, watching videos; talking to other passengers; talking on the phone, messaging, using social media; eating, drinking; relaxing, sleeping, doing nothing; other (e.g., taking care of children).

2. Data collection and methodology

The first test of the observation methodology was a survey conducted in the summer of 2019, which largely resembled the current study in terms of the monitored activities [24]. The subsequent data collection makes it possible to assess the effects of the four years that have passed between the surveys and potentially to examine the consequences of the phenomenon of increased digitalization, the pandemic, and remote work as well.

The current study focused on the Budapest metro network's M2 and M4 lines in order to maintain consistency with the previous study [24]. The technical characteristics and design of the five-car and four-car Alstom Metropolis trains running on the examined metro lines are practically the same, and the train intervals typically range from 2 to 5 minutes during peak hours. The M2 line has 11 stations with a total travel time of 18 minutes, while the M4 line has 10 stations, usually with denser spacing, and a total travel time of 13 minutes.

Through the first survey in 2019, 1029 individuals were monitored, while in 2023 a number of 1047 individuals were observed. The demographics of the observed individuals in 2023, including gender, age, and observation location (metro line), closely resemble the 2019 values, allowing a relevant comparison of the results. The characteristics of the samples from the two data collections are presented in Table 1. The surveys were conducted on weekdays between 7th and 20th June 2019, during the morning and afternoon rush hours: from 7 to 11 AM (22.2%) and from 3 to 6 PM (77.8%). The 2023 survey took place between 5th and 30th June, primarily in the late morning (52.9%) and in the afternoon (47.1%) periods. Data collection on both occasions covered the entire length of the lines but not every passenger on the trains.

Table 1. Characteristics of the 2019 and 2023 data collection samples

Characteristics	2019		2023	
	(N = 1029)		(N = 1047)	
Gender				
Male	469	45.6%	507	48.4%
Female	560	54.4%	540	51.6%
Age groups				
< 20	111	10.8%	156	9.4%
20–29	271	26.3%	552	33.4%
30–39	285	27.7%	411	24.9%
40–49	142	13.8%	241	14.6%
50–59	92	8.9%	136	8.2%
60+	128	12.4%	155	9.4%
Social group				
Blue collar workers	125	12.1%	72	6.9%
White collar workers	485	47.1%	491	46.9%
Students	244	23.7%	305	29.1%
Pensioners	106	10.3%	119	11.4%
Tourists	49	4.8%	53	5.1%
Other	20	1.9%	7	0.7%
Location of data collection				
M2 line	436	42.4%	427	40.8%
M4 line	593	57.6%	620	59.2%
Travel time				
0–5 minutes	334	32.5%	435	41.5%
5–10 minutes	443	43.1%	417	39.8%
10+ minutes	252	24.5%	195	18.6%

Data collection was conducted manually. The person conducting the survey determined and recorded the activities of the observed individuals based on one or more observations, assessing the type and frequency of activities performed. Due to the limitations of the study, there was no opportunity for detailed on-site interviews, so the activities were examined only to the degree that an external observer could reasonably determine with almost complete certainty. For example, in the case of a passenger using a mobile device, the recognition of well-known mobile applications, such as messaging or email apps, allowed for a more precise determination of the nature of the passenger's activity. However, without further detailed questioning, it was often not possible to determine whether the observed passenger was reading private or work-related messages or emails.

The observations were further contextualized by recording the timing of the observation, the exact journey details (i.e., boarding, and alighting stations), indirectly allowing for the calculation of travel duration. Additionally, the gender, presumed age group, perceived social group of the observed individual were also recorded.

After processing the data collected, the relationships between activities and activity groups, observed individual characteristics, and travel characteristics were examined. Finally, the results of the 2019 and 2023 data collections were compared, identifying differences and similarities between the two datasets. Descriptive statistics were used for the analysis.

3. Results

The results are presented based on the characteristics of the observed passengers and the travel itself (i.e., metro line, travel time). A detailed analysis was presented in the previous study [24] about the survey conducted in 2019, while this article focuses on the findings of the 2023 data collection, and the comparison of the two surveys.

3.1 Analysis based on age and gender

The distribution of the observed passengers’ activity groups is illustrated in Figure 1 by gender and age. Although there are no significant differences between genders, the results suggest that women engage slightly more in phone calls and messaging than men (about 3 percentage point difference, abbreviated later as ‘pp.’), as well as activities related to childcare, which constitute the main element of the ‘other’ category (2.5 pp.). Among men, common activities include ‘online browsing, gaming on mobile devices, video watching’, and ‘conversations with fellow passengers’, representing 4 and 2 pp., respectively.

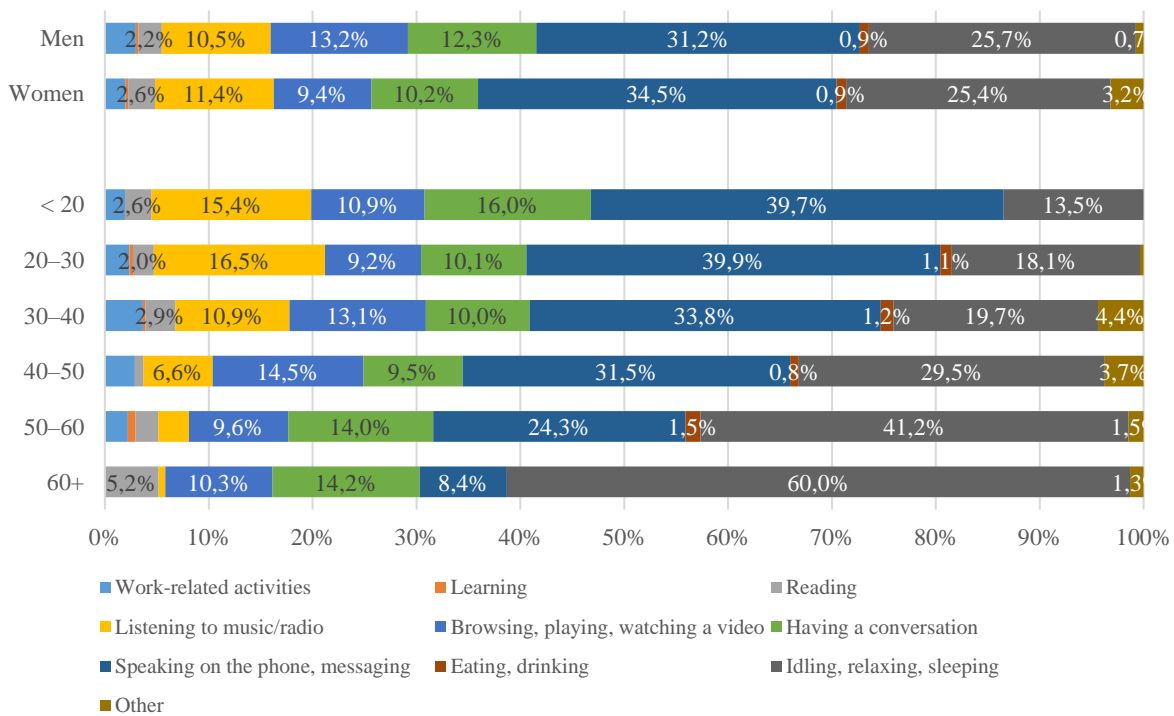


Figure 1. The breakdown of activity group shares by gender and age

Comparing the two datasets (2023 vs. 2019), a significant increase of approximately 8 pp. in the share of phone calls and messaging can be observed (6.5-pp. increase for women and 10 pp. for men)—despite the increase, this activity group remained more characteristic of women. A decrease in the proportion of personal communication is also visible in the results, approximately 7 pp. regardless of gender. There is a notable decrease in the category of ‘reading’, 6 pp. for men and 3 pp. for women, while ‘eating and drinking’ decreased by 2–2.5 pp. The proportions of other activity groups remain practically unchanged.

Examining the results by age, a general trend can be observed, that older passengers spend more time on relaxation and idleness during travel, and idleness increases with age in a strictly monotonic manner. In contrast, the proportion of phone calls and messaging during travel, as well as listening to music and radio, changes in the opposite direction—however, the peak value in both categories occurs in the 20–30-year-old age group. The proportion of activities requiring the use of mobile devices remains roughly constant, but the decline that could be observed in the 2019 dataset for people over the age of 60 practically disappeared by 2023.

An important change is that the proportion of phone calls and messaging has increased in all age groups: doubled in the age group of 50–60 years, tripled in the age group under 20, and increased by 5–8 pp. in the case of the others. Similarly, there is an expanding trend in listening to music, by approximately 3–4 pp. more among younger passengers, but also a 2.3-pp. increase can be observed among middle-aged individuals (e.g., in the 45–60 age group). The frequency of traditional reading has declined significantly, its share fell from the previous 5–10% to 1–5%. However, there has been an increase in the proportion of work-related activities, rising from 1–2% to 2–4% among working-age passengers.

The most notable difference is a significant increase in the proportion of ICT-related activities, almost independent of age, as well as the considerable growth in this activity group even among older passengers even surpassing the average. The decline in the occurrence of reading as an activity, and the detectable expansion of work-related activities also worth noting.

3.2 Differences according to travel time and metro line

The proportions of activities broke down by travel time intervals (0–5, 5–10, 10+ minutes) and metro lines are illustrated in Figure 2. In the 2023 survey, the proportion of work-related activities remains around 3% for short trips (< 5 minutes) and about 6% for longer trips, while listening to music represents nearly a constant share of 10% considering the different time intervals. However, there is a decreasing trend in the category of idleness and relaxation: while nearly one-third of activities fall into this category for trips shorter than 5 minutes, it decreases to only one-fifth for trips longer than 10 minutes—although this still means a 4-pp. increase compared to the 2019 data. This confirms the understandable habit that passengers are inclined not to engage in active activities during short trips. Among the activity categories showing an increasing proportion with time, there are ‘phone calls and messaging’, increasing from about 29% to 36.7% along with longer travel times, as well as ‘browsing, gaming, and video watching’ increased from 9% to 14%.

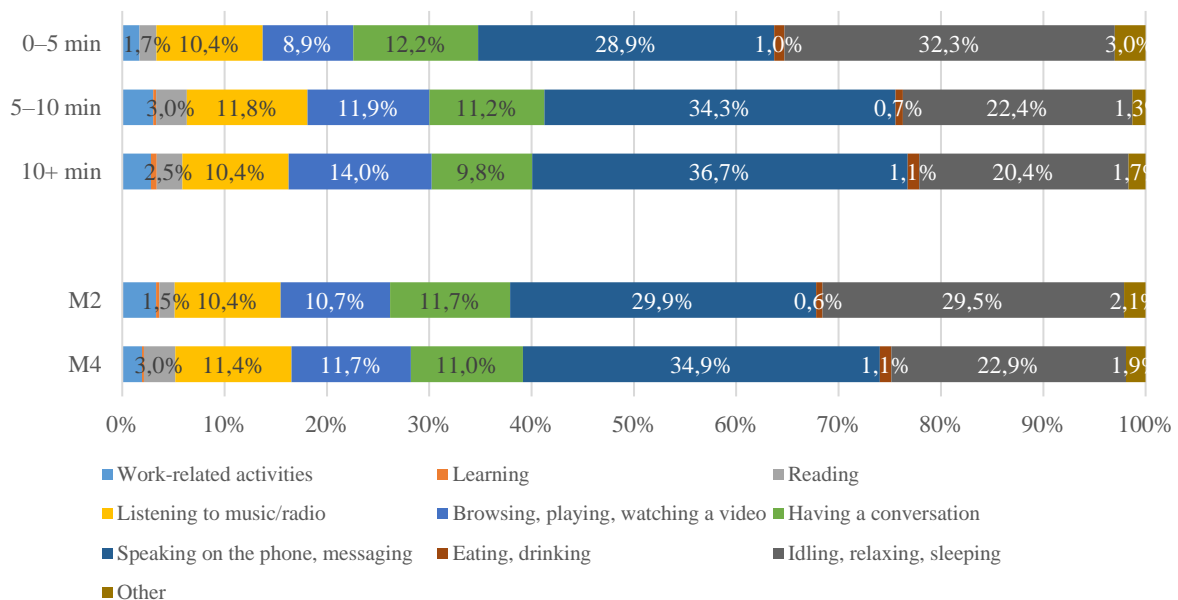


Figure 2. The breakdown of activity group shares by travel time and metro line

When comparing the activities based on travel time, most of the changes remained within 2–3 pp. from the previous analysis in most of the activity groups (e.g., studying, browsing, and video watching, listening to music). However, in some categories, there are significant deviations: for example, the

proportion of ‘phone calls and messaging’ has increased by 4 pp. for shorter trips, and by 9–11 pp. for longer trips. A notable decline can be observed in ‘conversation with fellow passengers’, with a decrease of 6–8 pp. across all travel times. Similarly, the share of ‘reading’ decreased by 3–6 pp., with the largest drop in the 5–10-minute travel time range.

When comparing metro lines, the distribution of observed activity groups is generally consistent. The differences between metro lines in terms of activity groups do not exceed 1.5–2 pp., with two exceptions. On the M2 line activities like ‘relaxation and idleness’, as well as ‘phone calls and messaging’, make up 29.5 and 30%, respectively, while on the M4 line, rates are less balanced, these categories represent 23 and 35% of the activities. Since the inside of the vehicles on both metro lines are identical, this difference may be credited to other characteristics of the observed passengers and their trips. One possible explanation is the differences in age distribution among passengers, as depicted in Figure 3. On the M4 line over two-thirds (68%) of passengers were under 40, while on the M2 line they had a share around 56%. This may explain the higher proportion of activities that occur more frequently in case of older passengers (see Figure 1).

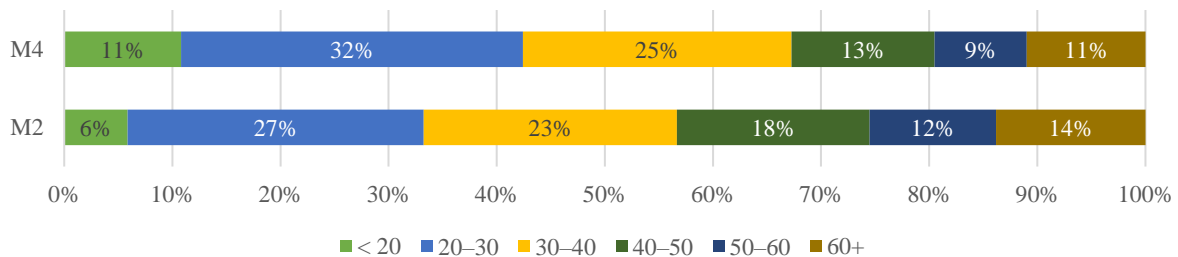


Figure 3. The representation of each age group on the metro lines (survey of 2023)

3.3 Tendencies for the whole sample

After conducting the analyses based on the characteristics of individual travellers and the attributes of their journeys, the changes in the whole sample came to the focus. The changes in the proportions of various activities based on all observations from the 2019 and 2023 surveys are illustrated in Figure 4. Among the aggregated changes, the nearly 8-pp. increase in the category of ‘phone calls and messaging’ stands out prominently. This also demonstrates the rise of digital activities, especially when compared to the decline in personal communication (i.e., conversation with fellow passengers) decreased by nearly the same extent.

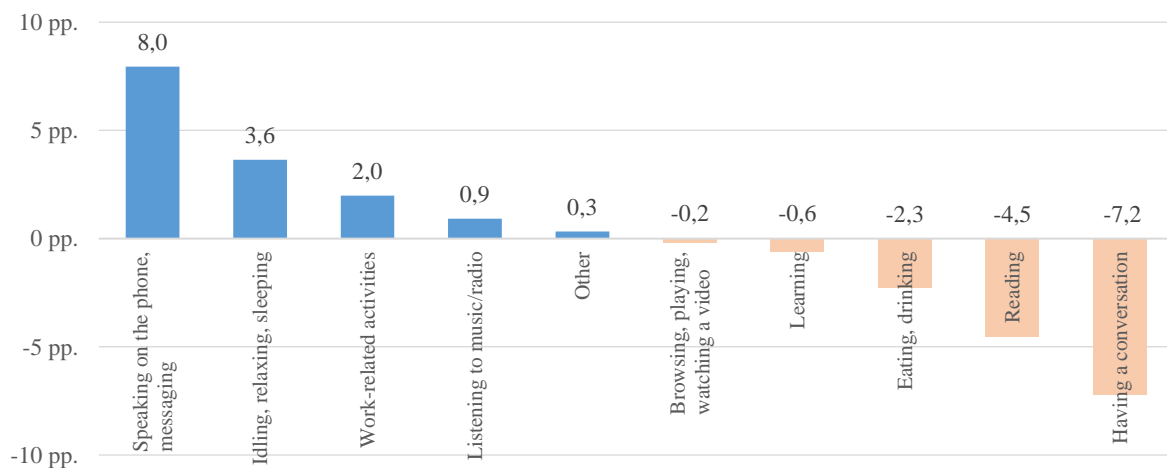


Figure 4. Changes in the share of each activity group in surveys in percentage points (2023 vs. 2019)

The 4-pp. increase in the category of ‘relaxation and idling’ is noteworthy; this was probably not caused by a change in habits but made possible by the available seats in less crowded periods. The growth in the proportion of work-related activities also worth noting in case of certain passenger groups. Although traveling on the metro cannot provide ideal conditions for intellectual work (e.g., silence, suitable surface for typing), the proportion of this activity category has still expanded, likely due to the increasing

digital access and the growing acceptance of remote work during and after the pandemic. (The growth in ‘listening to music and radio’, as well as activities classified under the ‘other’ category is minimal, like the ‘use of mobile devices for browsing, gaming’, and the decrease in the proportion of ‘studying’.) By 2023, the proportion of ‘eating and drinking’ in the activities decreased by approximately 2 pp., this is likely at least partly attributable to the fact that the 2023 survey was conducted further from the typical mealtime periods (e.g., breakfast). Significant decreases can be observed in ‘reading’ (4.5 pp.) and having a ‘conversation with fellow passengers’ (7.2 pp.), which is likely associated with a higher proportion of digital device usage and the greater share of relaxation.

Conclusions

The article compared the travel activities of passengers on two metro lines in Budapest, based on two similar surveys with analogous methodology. Conclusions were drawn based on over a thousand observations in case of both surveys. While the results closely resemble those presented in the 2019 data collection, several significant differences can be observed between the two surveys.

The conducted surveys confirm that as the age of the passengers increase, travel time shortens, the share of work, mobile device use, and nearly all “active” activities decline, while idleness, relaxation (i.e., “passive” activities) became more dominant. A significant difference can be observed between the results of the two surveys in the proportion of phone calls, written messages, and personal, on-site communication. The observation rates of these two activity categories changed in a complementary manner: online and telecommunications exceeded the 2019 results by approximately 8 pp., while personal communication fall by 7.2 pp. in 2023. This change, combined with the significant (4 pp.) decrease in the category of ‘reading’ indicates further expansion of communication through virtual and digital channels and a decline in the importance of personal communication and traditional channels. It is also worth mentioning that the proportion of work performed on vehicles increased by approximately 2 pp. for the whole sample, and even greater increases were observed in certain age groups. These can be the effects of the increased opportunities and acceptance for remote work, along with the flexible communication and work requirements associated with it. Although only four years have passed between the two surveys, shifts can still be seen in age-related breakdowns, indicating the increasing use of mobile devices among middle-aged and older passengers.

Future research can lead in several directions. The data obtained from surveys worth expanding, since in order to explore and prove other interesting trends, it is important to find the statistically significant similarities and differences. Furthermore, it may be useful to examine the expectations and attitudes of passengers regarding travel activities in details, as well as determining the reasons and drives for choosing activities during travelling.

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