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PERSONAL FACTORS IN MOBILITY PLANNING WITH VIRTUAL ACTIVITIES

Summary. The main reason for contemporary transport problems related to traffic congestion in urban transport networks is the excessive number of passenger cars used by people commuting to work (i.e., to places where they carry out their work duties). During the COVID-19 pandemic, a significant reduction in traffic flow was observed due to the implementation of remote work. Currently, transport problems are similar to those observed before the pandemic period. This article presents the results of research and a discussion on various factors, the recognition and analysis of which enable the virtualization of activities related to work duties. Contribution to the development of science and knowledge in the field of transport, and in particular in urban mobility planning, justifies the need for in-depth research taking into account, among other matters, objective and subjective personal factors in the assessment of social generation preferences to carry out activities in a virtual form (e.g., remote work). Proper recognition of these factors enables the development of mobility plans that can significantly reduce traffic congestion.

1. INTRODUCTION

Mobility management in urbanized areas is related to the process of mobility planning for individual facilities and for the entire urbanized area, namely, sustainable urban mobility plans [1]. Mobility management may concern a microscopic scale (i.e., individual objects at the facility level or groups of objects), as well as a macroscopic scale (i.e., an urban area on the scale of a district, city, urban agglomeration, or even a region, which represents the supra-local level). The urban/agglomeration/regional scale may take into account mobility management for all users and transport systems, selected user groups, selected travel purposes (e.g., work, education, shopping, entertainment, recreation), selected activities (e.g., specific work duties, specific work processes, specific tasks and activities in work processes), and selected objects that generate traffic (e.g., workplaces, shopping centers, schools, universities, places of entertainment and recreation). The expected results of mobility management are changes in the transport behavior of people who use appropriately developed mobility options resulting from the mobility measures contained in the prepared mobility plan [2].

Contribution to the development of science and knowledge in the field of transport, and in particular in urban mobility planning, justifies the need for in-depth research taking into account, among other matters, objective and subjective personal factors in the assessment of social generation preferences to carry out activities in a virtual form (e.g., remote work). The issues presented in the paper are also important in the context of the current (April 7, 2023) amendment to the Polish legal act on labor law.

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This amendment introduces the term "remote work" and an entire chapter covering the right and conditions for remote work for the employer and the employee [3].

The aim of this research was to provide the initial recognition of objective and subjective personal factors shaping cause-and-effect relationships that enable the use of effective mobility planning tools and the identification of new functional conditions using generational preferences in the virtualization of activity towards remote work. Such new conditions result in a potential reduction of passenger traffic flows in transport networks for absolutely obligatory activities related to work and education. On the other hand, an increase in the share of virtual activities related to remote shopping may result in increased freight traffic on the so-called last mile (i.e., in the last link of the supply chain, specifically during the delivery of courier shipments to the customer or to a nearby parcel locker).

This article is structured as follows. The introduction characterizes the research problem in terms of the contribution of the presented research and the results obtained to the development of science and knowledge. Section 2 contains an overview of the current state of knowledge regarding the key issues of the research problem (e.g., mobility management in the context of transport needs and virtual activities in the context of mobility planning). The concept of generations in relation to the surveyed group of respondents is also presented in Section 2. Section 3 discusses the methodology and basic characteristics of the research sample based on the conducted research. Section 4 presents a discussion of the results with their graphical presentation and commentary. Section 5 ends the article with conclusions.

2. VIRTUAL ACTIVITIES IN MOBILITY PLANNING

Transport needs result from a lack of temporal and spatial compatibility of material and personal factors necessary for manufacturing activity and human life (i.e., for the implementation of personal activities) [4]. The sources of transport needs lie in the essence of socio-economic phenomena; they are related to their organization and functioning, and they evolve interdependently. Servicing transport needs are transport processes that directly result in traffic flows in transport networks and the impact of these processes on the socio-economic system and the natural environment, especially when traffic congestion occurs [5].

2.1. Mobility planning: Synthetic characteristics

The purposes of mobility planning and mobility management are to increase the degree of sustainability of urban mobility and to reduce car traffic flows in transport networks (i.e., to reduce traffic congestion). Mobility management measures can be divided into those that enforce certain transport behaviors of users (which are often in the form of regulations and laws) and those with which the user may or may not comply. There is also a division into "pull" measures, which are observed in the form of incentives to use sustainable modes of transport, and "push" measures aimed at reducing car transport [6].

Mobility management is focused on measures shaping the transport behavior and preferences of people when deciding how to make trips. These pre-trip decisions are primarily soft measures within the organization of transport services, using information, communication, organization, and coordination. Soft measures are "incentives" related to travel modes that represent alternatives to the passenger car. The term "incentives" has been put in quotation marks because, for users who prefer to use cars, some of these measures may be perceived as impediments or even restrictions [7]. On the other hand, hard measures related to the modernization and development of transport infrastructure and transport means, as well as formal and legal regulations, are conditions of an obligatory nature for users and their transport behavior and preferences. In addition, the use of existing transport infrastructure and transport systems in mobility management makes soft measures less costly than hard measures.

Mobility options within a mobility plan describe the target transport behavior and preferences of the target group of people expected from the implementation of the plan. Mobility options define the type

of transport behavior that is promoted among people carrying out specific activities (e.g., resigning from a passenger car for traveling on foot or other means of transport). In the process of shaping mobility (i.e., changes in transport behavior), it is important to identify external factors describing the accessibility of users to transport services during a specific activity, as well as objective and subjective personal factors related to the characteristics of people belonging to groups using the mobility plan [6]. Objective personal factors include age, gender, living conditions, and working conditions that may affect the change of working hours, change of workplace, change of place of residence, change of the form of work to remote work, etc. Subjective personal factors include personal characteristics related to activities, transport behaviors, and preferences, as well as the current level of awareness regarding the change in mobility (level 1 = initial state of mobility awareness, level 2 = mature state of mobility awareness, level 3 = state of preparation for mobility change, level 4 = maintaining the mobility change made).

The preparation and implementation of a mobility plan for specific activities, people, and facilities is a step-by-step process that includes the assessment of the planned measures and their results, which allows the reasons for changes in the transport behavior of people who use this plan to be identified. The assessment process takes into account three levels of impact of the mobility plan on shaping transport behavior: level I = level of services, level II = level of mobility options, level III = level of long-term effects. Mobility activities, mobility options, and effects on mobility plan users in the following aspects are assessed: awareness, approval, use, and satisfaction [6]. The assessment also concerns long-term effects in relation to transport behavior and preferences and their impact on traffic flows in transport networks (e.g., reducing traffic congestion) [8, 9].

2.2. Activity virtualization, modern technologies, and social generations

Among the many mobility measures concerning specific mobility options, some are aimed at reducing traffic flows in the transport network by reducing the number of trips. Examples of such measures are flexible working hours, working time compression, and remote work for activities that can be carried out virtually [10] (i.e., activities that do not require one to travel to and from the place of activity/work) [11].

Mobility measures increasingly include aspects of activity virtualization with the use of modern information and communication technologies. These include such aspects as the nature of activity in terms of time and space [12] and interpersonal interactions in time and space relations [13, 14]. The first group of aspects includes real activities (e.g., working at the place of employment, shopping in a store, visits) and virtual activities (e.g., working outside the place of employment using online video communications, shopping in online stores, arranging virtual visits using video communication services). The second group of aspects includes [10, 11]:
  – coexistence: being together in the same place at the same time
  – spatial collocation: people staying in the same place but at different times
  – time collocation: people meeting at the same time (synchronously) but from different places,
  – no collocation: people staying in different places at different times (asynchronous)

2.3. Social generations

It is possible to assign respondents according to social generation in order to take into account the impact of objective and subjective personal factors in the context of social attitudes and attitudes toward modern technologies, which are the basic tools for the implementation of virtual activities. In this approach, a social generation comprises all people born and living around the same time and period who are considered as being together. This period can also be described as the average period, generally considered to be around 20–30 years, during which children are born and grow up, become adults, and

start having children. "Generation" is also often used as a synonym for "cohort"[3] in the social sciences and refers to "people in a particular population who experience the same significant events over a period of time." Social generations are cohorts of people born within the same date range and who have similar cultural experiences. This generational awareness, called common socio-cultural location, is one of the three features that connect generations. The other two features are common temporal location (generational place or birth cohort) and common historical location (generation as reality or exposure to a common era).

Beliefs about generations are stereotypes (i.e., harmful and unjustified generalizations based on which judgments about the essential characteristics of a particular person are made based solely on their belonging to a particular generation) [15]. Although stereotypes are not included in the present research, they can complement the analysis of the results regarding the virtualization of activity, in particular in the context of social attitudes and attitudes toward modern technologies. In addition, the stereotypical characteristics of generations are significantly dependent on the country, its history, culture, socio-economic system, and other factors, resulting from the mentioned three features that connect people from particular generations. Therefore, the stereotypical characteristics of four successive generations given for the inhabitants of Poland are synthetically presented below because the presented research was carried out in Poland:

- The baby boomers are people born after World War II in the years 1946–1964, during the baby boom period. They are the oldest workers in the labor market. They are described as loyal people but struggle with massive unemployment—they want to work, but due to problems with modern technology, it is difficult for them to find suitable employment.
- Generation X (Gen X) is a cohort following the baby boomers (1965–1980). The determinants of belonging to this generation are abnegation, a nonchalant style and way of life, and colorlessness. These people reject the world and the "rat race" created by marketing and the system. This cohort does not include people focused on consumerism or employees of corporations whose goals are precisely to promote the "rat race," consumerism, and snobbery.
- Generation Y (Gen Y), or millennials, follow Gen X and are usually defined as people born from 1981–1996 (i.e., the generation that grew up in the period of computerization and the development of the Internet). These people actively use modern technologies and digital media in every area of life, but this leaves them little time to think autonomously and form their own views. They often live longer in the household with their parents than previous generations, delaying their transition into adulthood. They are characterized by high opinions of their skills, a belief in their own uniqueness, excessive expectations, and strong aversion to criticism. They want to work but not all their lives; they think about their future in retirement, they make long-term plans, and they grew up in the realities of the free market and willingly start their own businesses. Long-term stable work is not important to them, and they are often considered disloyal employees. They expect a lot of freedom and flexible working time, and their workload cannot limit them. They expect employers to set goals and lead them "by the hand."
- Generation Z (Gen Z) are Gen Y's successors, born between 1997 and 2012. This generation is also called the "multitasking generation," "silent generation," and "Generation V." Recently, young employees from Generations X and Y have often been called "Generation C," representing the adjective "connected," as they are constantly connected to the Internet and using social media every day for private and professional communication. They are the first people to have grown up in a fully digitized society. They gain knowledge from the Internet and are focused on finding information quickly. It is important for them to share information through social media. During their lives, they often change jobs, have different views on what loyalty means in the workplace, and find themselves best in positions in the IT industry. It is estimated that these are people for whom the use of modern technologies and automation of activities is the norm.

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[3] In statistics, marketing, and demography, a cohort is a group of entities that share a common characteristic (usually people who have experienced a common event in a selected period, such as birth or graduation).

It should be emphasized that the concept of social generation is also the object of criticism, including the criticism that the use of "generation labels" are "imposed by survey researchers, journalists or marketing firms" and "drive people toward stereotyping and rash character judgment" [16]. Furthermore, there are criticisms that "there is no empirical basis" for the contention "that differences within a generation are smaller than differences between generations." This is due to the fact that generational theories "seem to require" people born at the tail end of one generation and people born at the beginning of another to "have different values, tastes, and life experiences." An additional justification for the critical position is that people born in the first and last birth years of a generation "have more in common" than with people born a couple of years before or after them [17]. However, it was assumed that in the preliminary studies presented in this article, the inclusion of the above-mentioned generations in the analysis of the results regarding preferences for activity virtualization does not affect the obtained results but simply offers an additional level of analysis.

3. RESEARCH METHODOLOGY AND CHARACTERISTICS OF THE SURVEY SAMPLE

Most of the data for both objective and subjective personal factors can be obtained from surveys conducted among the target group: people for whom a mobility plan is being developed [6]. Before starting the actual research, it is recommended to conduct preliminary (pilot) research, which will cover only a small number of project participants [18, 19]. The purpose of this approach is to check the correctness, transparency, and understanding of the questions in the questionnaire; estimate the scope of feedback; estimate the size of the sample (the group of respondents covered by the relevant research); and provide additional information on the tested data collection methods [20].

This is the pilot approach adopted in the presented preliminary studies because there was a need to estimate the scope of feedback in order to analyze the cause-and-effect relationships between personal factors shaping the conditions for performing work-related activities and the possibility of doing this work virtually [21, 22]. It was assumed that *virtual activity* and, in this case, *virtual work* include remote work or a hybrid form of work (i.e., work done partly at the workplace and partly remotely), taking into account fixed working hours, flexible working hours, and a mixed form of these hours.

The research targeted people from many different professions from many different workplaces in many different industries. Respondents were also selected in terms of age in such a way that the sample had an appropriate representation of representatives of four generation groups—namely, baby boomers, Gen X, Gen Y, and Gen Z. Pilot surveys were conducted in 2021 during the COVID-19 travel restrictions [23, 24]. The Pen-and-Paper Personal Interview (PAPI) technique was employed with the use of a questionnaire sent and collected via e-mail and the computer-assisted telephone interviewing technique. The collected data statistically describe the research sample of 100 respondents. The questionnaire contained 16 problem questions and asked for the basic characteristics of the respondents.

The structure of respondents in terms of age and surveyed generations is shown in Fig. 1. The gender of the respondents is shown in Fig. 2a. The education of the respondents is shown in Fig. 2b. The above-mentioned features of the study sample are largely similar to the features observed in the population of inhabitants of the research area (Silesian Voivodship in Poland).
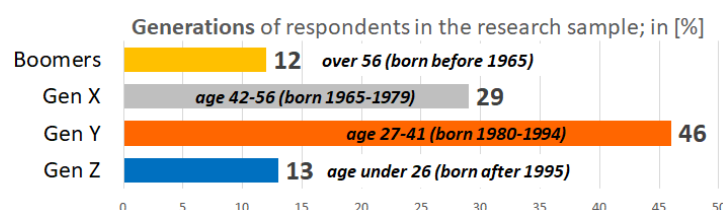

Generations of respondents in the research sample; in [%]

Boomers	12 over 56 (born before 1965)
Gen X	age 42-56 (born 1965-1979) 29
Gen Y	age 27-41 (born 1980-1994) 46
Gen Z	13 age under 26 (born after 1995)

Fig. 1. Generation of respondents in the research sample

Further characteristics of the respondents concern the following issues: "Respondents living alone or together" (Fig. 3a) and "Additional education activity" (Fig. 3b). The results indicate that the

percentage of respondents living alone does not exceed roughly 12%, and the vast majority of respondents live with a roommate or with a family. On the other hand, additional education activity dominates among Gen Z respondents (77%), but in the remaining generations, the proportions in this matter are opposite to those in Gen Z. In terms of the overall sample ("All"), additional education activity is only 28%.
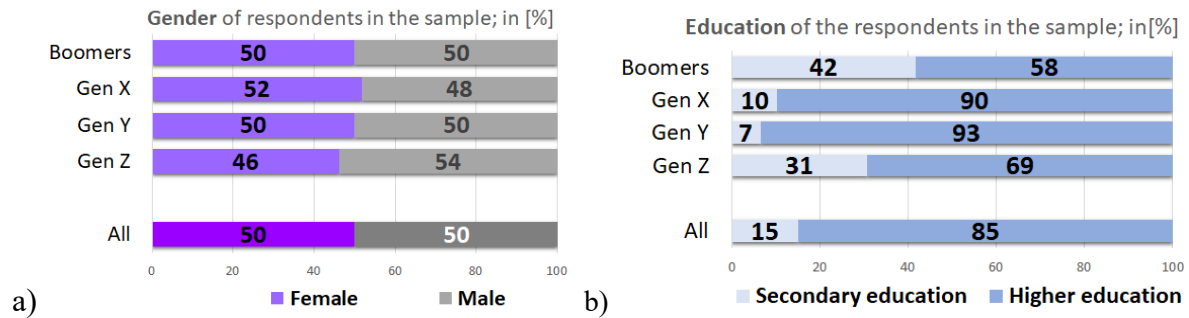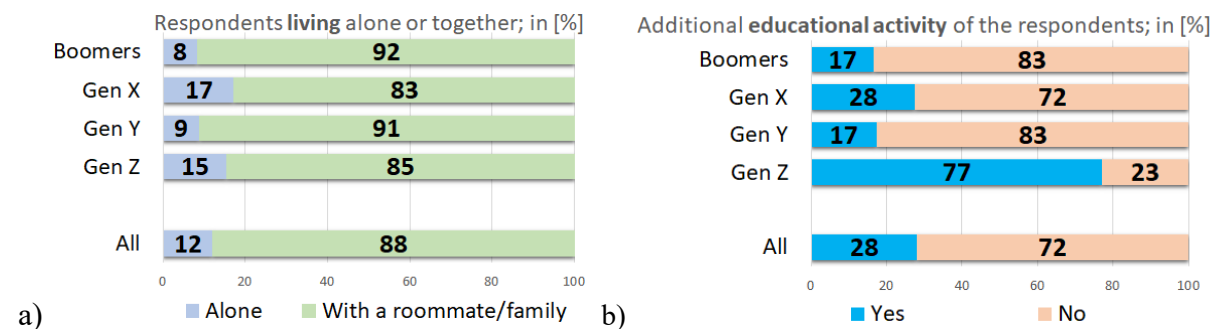

Fig. 2. Characteristics of the respondents: a) gender and b) education

Fig. 3. Characteristics of the respondents: a) respondents living alone or together and b) additional education activity of respondents

The sample is significantly diversified in terms of "Industry of the primary activity" (Fig. 4). It should be noted that "All" is dominated by "Production/Industry" (26%) and "Education and Science" (22%). Next are "Transportation and Shipping" (14%), "Banking/Finance/Accounting" (11%), and "State/Local government administration" (11%). Other "Industry" does not exceed 6%. However, the share of Industry of the primary activity in individual generations is different than in the "All" approach. Baby boomers and Gen X respondents are dominated by "Education and Science" (31%), Gen Y is dominated by "Production/Industry" respondents (27%), and Gen Z is dominated by "Transportation and Shipping" respondents (31%).

The presented differentiation of "Industry of the primary activity" is important during the cause-and-effect analysis of the susceptibility of these particular respondents to the virtualization of activity for remote work because each type of industry is characterized by specific features, which are a set of objective personal factors for the virtualization of activity for remote work. For example, the vulnerability of the "truck driver" activity to virtualization is practically zero, but the vulnerability of the "freight forwarder" activity to virtualization is practically complete. Moreover, both sample activities belong to the same industry ("Transportation and Shipping").

4. DISCUSSION

When analyzing the results, it should be remembered that the surveys were collected in 2021 (i.e., during the COVID-19 pandemic and in the context of the related restrictions on movement and the introduction of remote work in activities related to science and education, administration, management, and healthcare at an unprecedented scale) [25–30]. Such a period for research was deliberately selected to take into account the real conditions related to the examined problem.
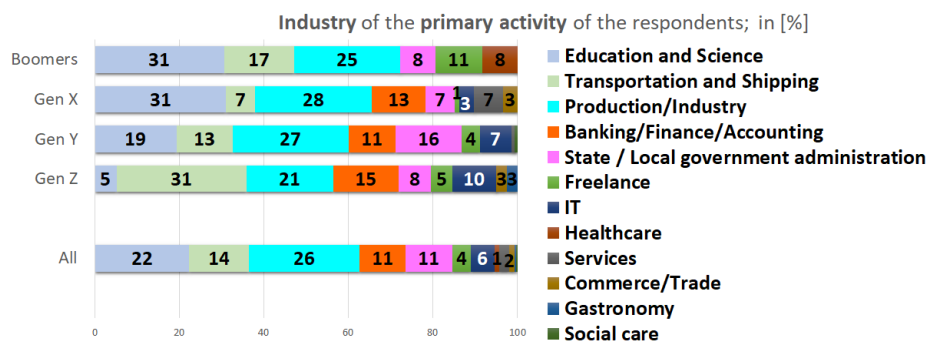
Fig. 4. Industries of the primary activities of respondents in the research sample

The logic of the analysis and discussion of the results presented in the following subsections of this section covers the following issues:

1) Identification of the state, including the share of current forms of work and working hours among respondents under the conditions of travel restrictions during the COVID-19 pandemic;

2) Diagnosis of the condition (during pandemic restrictions on movement) covering the following problem issues: acceptance/satisfaction with current forms of work and working hours, assessment of satisfaction with the current remote work, factors of satisfaction and dissatisfaction with the current remote work;

3) Assessment of the potential for changing the form of activity to remote work (after the end of the pandemic), including the declaration of remote work (after the end of the pandemic) and favorable and unfavorable factors and challenges in remote work;

4) Assessment of the virtual form (remote work) in the following aspects: the impact of forms of work on motivation to perform work duties and motivating factors, attitudes toward modern IT and ITC technologies, and factors affecting the change of work/profession/industry after the pandemic.

The content of the above points and discussion logic and their sequence have been developed in accordance with the methods of transport systems engineering [20, 31, 32] to constitute a coherent supplement and functional extension of the process of developing mobility plans. As a result of such an approach, the results and conclusions justify the postulated need to use in-depth focus groups, taking into account, among other factors, objective and subjective personal factors in the assessment of people's generational preferences to carry out activities in a virtual form (e.g., remote work).

4.1. Identification of the state of current forms of work and working hours (during COVID-19 pandemic restrictions on movement)

Taking into account the overall sample ("All"), the current form of work during the pandemic was almost evenly distributed among the surveyed forms: "Remotely" (36%), "In the workplace" (33%), and "Hybrid" (31%) (Fig 5a). The smallest share of "Remotely work" was held by baby boomers (8%), with the remaining two forms of work dominant at a similar level: "Hybrid" (50%) and "In the workplace" (42%). It is worth noting that in the remaining three generations, the distribution of forms of work is more even than in the case of baby boomers. However, taking into account the forms regarding working hours, the form "Fixed hours" in the COVID-19 pandemic 2021 was dominant, regardless of generation (Fig. 5b).

4.2. Diagnosis of remote working conditions (during COVID-19 pandemic restrictions on movement)

Acceptance/satisfaction with current forms of work and working hours

The results of the assessment of current forms of work and working hours in terms of satisfaction/suitability are presented in Fig. 6a. In all generations and in overall terms ("All"), the most satisfactory/suitable form is the "Hybrid" form (30–37%). The baby boomer generation ("Hybrid" =

35%) also strongly prefers "In the workplace" (22%), "Flexible hours" (22%), and "Fixed hours" (17%). On the other hand, "Remote work" is preferred by only 4% of respondents of this generation. In Gen Y, "Fixed hours" is preferred by only 8% of respondents. The remaining Gen X and Gen Z preferences in this matter are very similar.
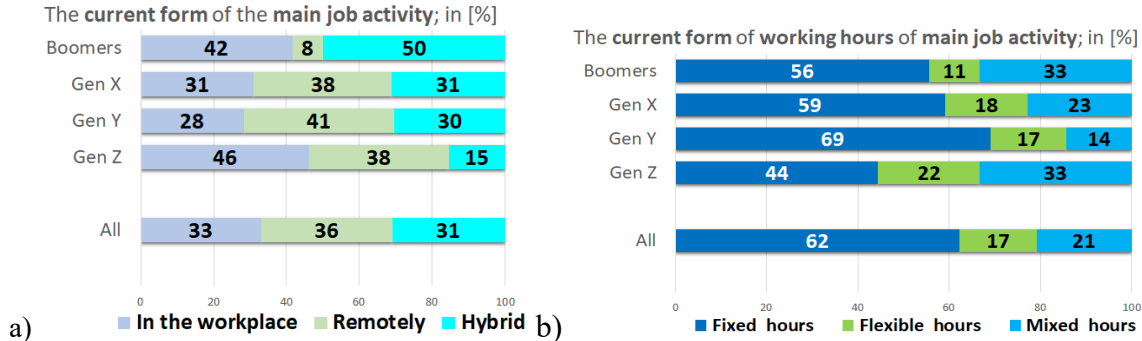

Fig. 5. Forms of activities during the COVID-19 period of 2021: a) the current form of the main job activity and b) the current form of working hours of the main job activity
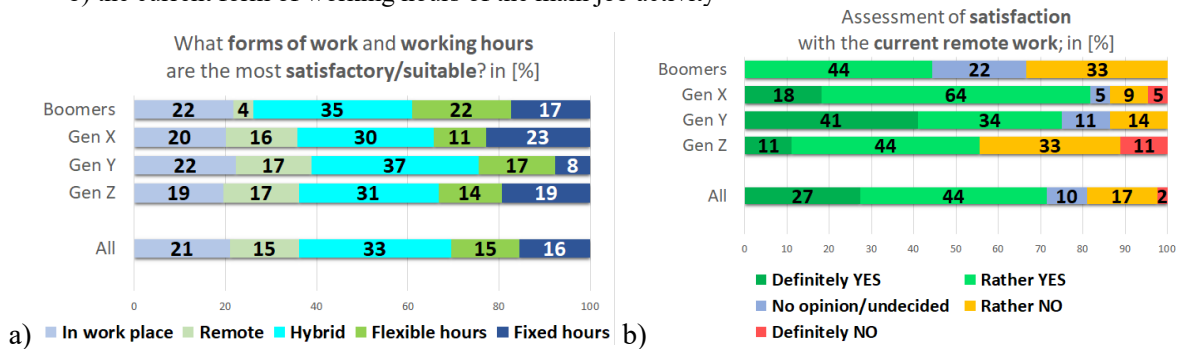
Fig. 6. Condition diagnosis: a) "What forms of work and working hours are the most satisfactory/suitable?" and b) an assessment of satisfaction with current remote work

Assessment of satisfaction with current remote work

The results of the assessment of satisfaction with current remote work in terms of "All" indicate high satisfaction based on the responses of "Rather YES" (44%) and "Definitely YES" (27%) (Fig. 6b). The best ratings for remote work were provided by Gen Y (34% for "Rather YES" and 41% for "Definitely YES") and Gen X (64% for "Rather YES" and 18% for "Definitely YES").

Factors of satisfaction and dissatisfaction with current remote work

The most prominent satisfaction factors with remote work are "Economic factors, time and travel costs savings" (23–30%), "Flexibility of working hours, time management" (15–20%), "Convenience, comfort and safety of home privacy" (8–23%), and "Favorable nature of work and its better organization" (4–20%). Other factors are indicated to a much lesser extent (Fig. 7).

The most prominent dissatisfaction factors with remote work are "No direct/personal contact with supervisor or co-worker" (20–27%), "No direct contact with people" (9–24%), "Lack of physical activity, fatigue and monotony of working with a computer" (5–20%), "Technical problems (Internet connection, hardware, software)" (5–17%), and "Distracted by other activities and caring for children" (5–12%). Other factors are indicated to a much lesser extent (Fig. 8).

4.3. Assessment of the potential for changing the form of activity to remote work

Declaration of remote work after the end of the pandemic

An assessment of the potential for activity virtualization based on the declaration of intention to do remote work after the end of the pandemic (Fig. 9) indicates that only 8% of baby boomers declared

"Definitely YES." Similarly, a small percentage of Gen Z declared in favor of virtualization, but it is worth noting that this generation is also the most undecided, as 46% declared "No opinion/undecided."
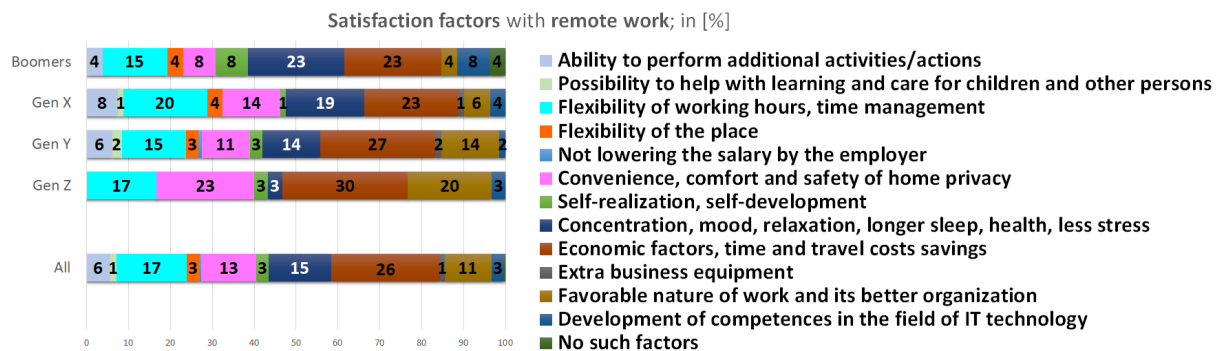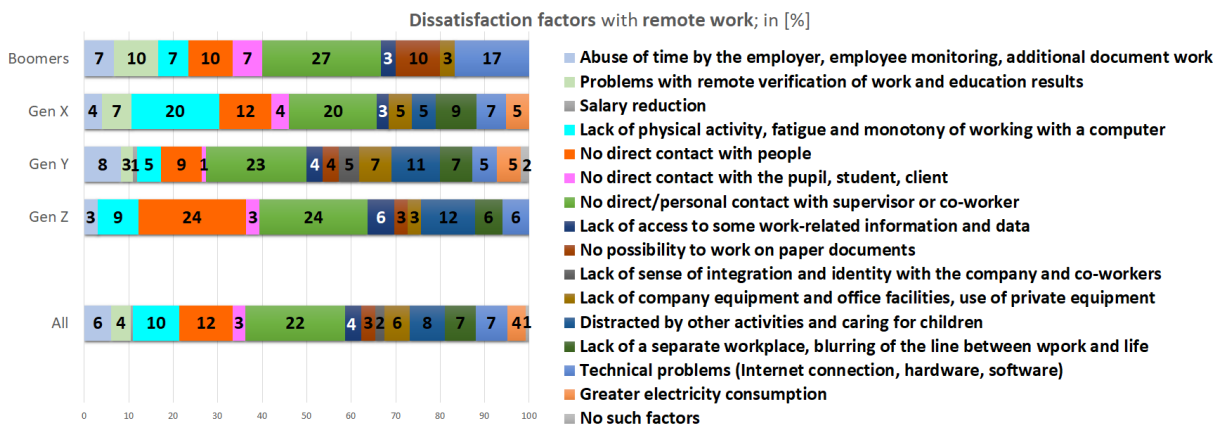

Fig. 7. Satisfaction factors with remote work

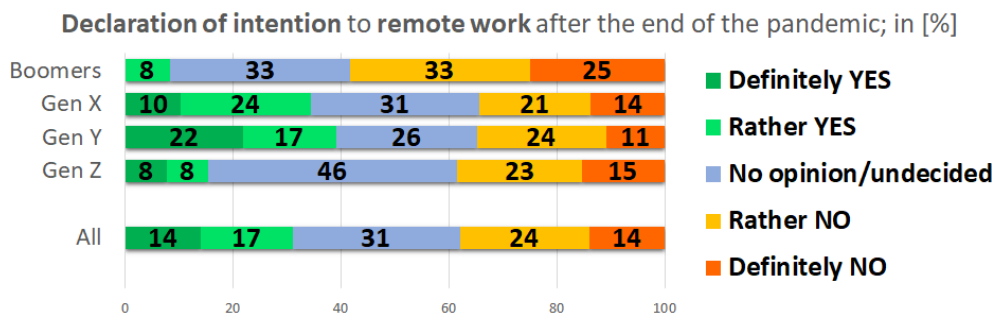Fig. 8. Dissatisfaction factors with remote work

Fig. 9. Declaration of intention to do remote work after the end of the pandemic

Favorable and unfavorable factors and challenges in remote work after the end of the pandemic

An assessment of the potential for activity virtualization based on factors inducing/convincing people to do remote work (Fig. 10) indicates that factors such as "Possibility of performing other activities" (15–20%), "Convenience/comfort" (11–20%), "Calmness, focus, concentration" (16–20%), and "Flexible working hours" (14–19%) were important to respondents.

An assessment of the potential for activity virtualization based on factors that are not conducive to remote work (Fig. 11) indicates that the participants cited factors such as "Difficult contact with colleagues/co-workers" (15–21%), "Blurring the line between work and personal life" (15–18%), "Technical factors/problems" (9–18%), and "Difficult contact with superiors" (9–12%).

An assessment of the potential for activity virtualization based on Skills as challenges in remote work (Fig. 12) indicates that the following skills are the most dominant challenges: "Time management skills" (23–29%), "Self-motivation" (18–22%), "Independence/self-control" (13–21%), and "Adapting to the changes" (15–18%).
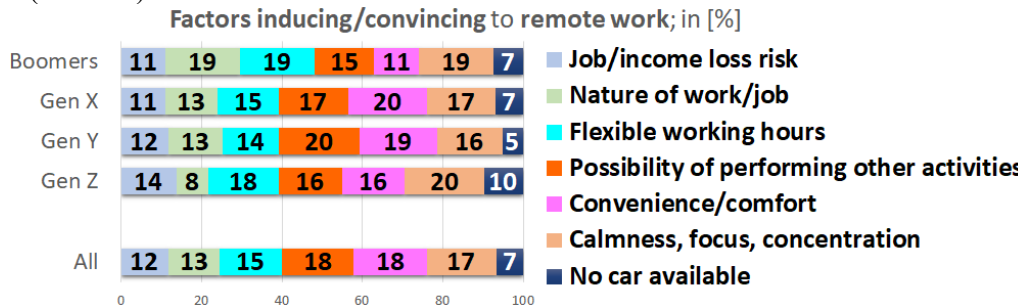

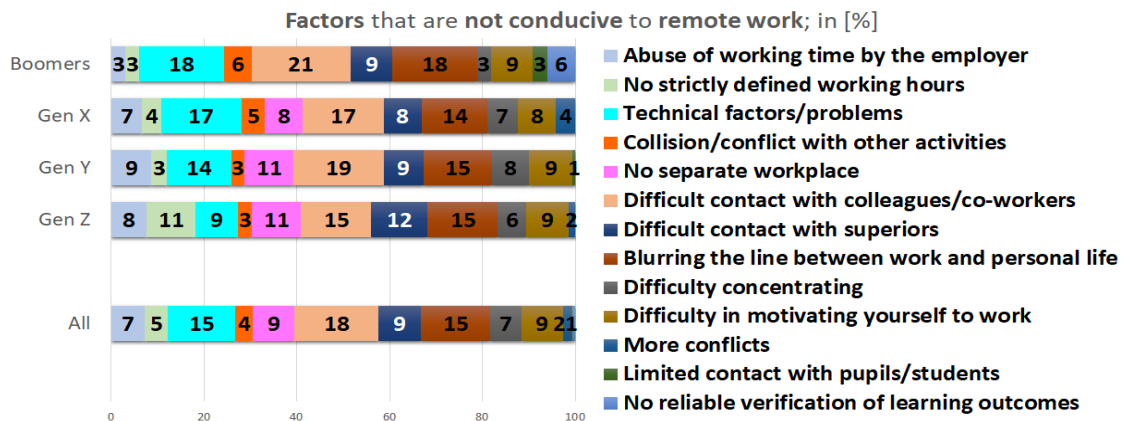Fig. 10. Factors inducing/convincing respondents to do remote work

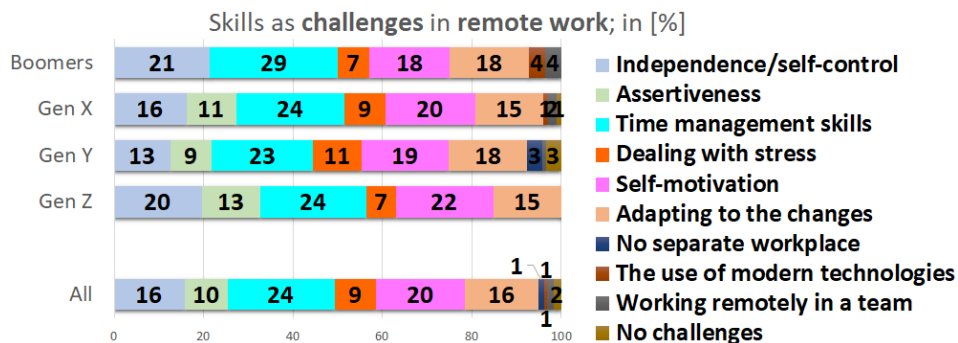Fig. 11. Factors that are not conducive to remote work

Fig. 12. Skills perceived as challenges in remote work

4.4. Assessment of the potential for changing the form of activity to remote work

The impact of the form of work on motivation to perform work duties and motivating factors

Respondents answered the question, "Which form of work has a positive effect on the motivation to perform work duties?" The results show that the declaration "The form of work does not matter" dominates the overall ("All") sample (45%) and is even more dominant among respondents from Gen X (49%) and Gen Y (52%). However, for baby boomers (42%) and Gen Z (46%), the declaration "Definitely in the workplace" dominates (Fig. 13).

Factors affecting motivation and involvement to perform work duties are as follows: "Relationships with colleagues and co-workers" (14–31%), "Pay and salary" (22–25%), "Work-life balance" (14–

17%), "Opportunity for career advancement" (11–17%), "Praise and appreciation from the management" (11–14%), and "Training and courses increasing qualifications" (6–11%). Other factors were indicated much less frequently (Fig. 14).
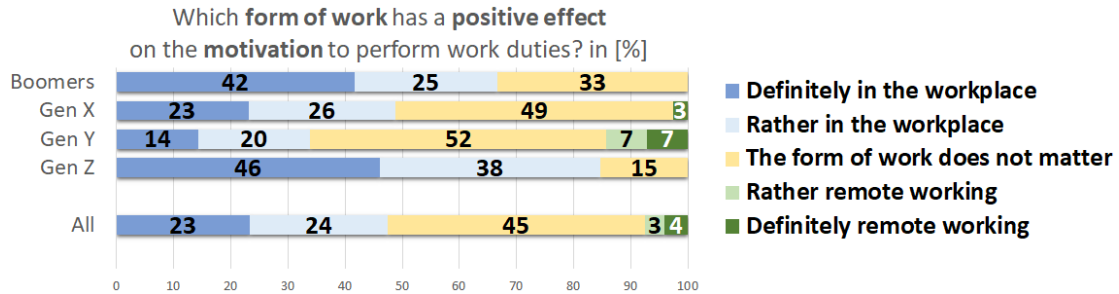

Fig. 13. Answers to the question, "Which form of work has a positive effect on the motivation to perform work duties?"
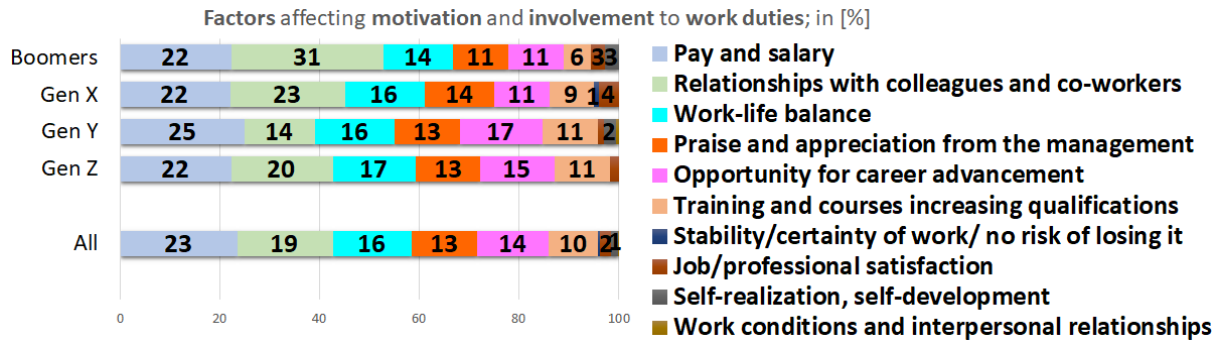

Fig. 14. Factors affecting motivation and involvement to work duties

Attitude toward modern IT and ITC technologies

Respondents answered the question, "Are modern technologies a challenge in remote work?" The results indicate that in general terms ("All"), new technologies are not challenging (32% for "Rather NO" and 55% for "Definitely NO"). A similar approach to new technologies was declared by Gen Y and Gen Z. However, modern technologies are a challenge for Gen X and baby boomers: 10% for "Rather YES" (Gen X), 17% for "Definitely YES" and 8% for "Rather YES" (baby boomers) (Fig. 15).

Respondents primarily perceive new technologies in remote work in the following ways: "I perceive it as a modern source/tool of knowledge" (28–36%), "I like to use new technologies" (22–44%), "I have nothing against new technologies" (12–35%), and "I use new technologies carefully - I care about my digital identity and digital security" (9–16%) (Fig. 16).
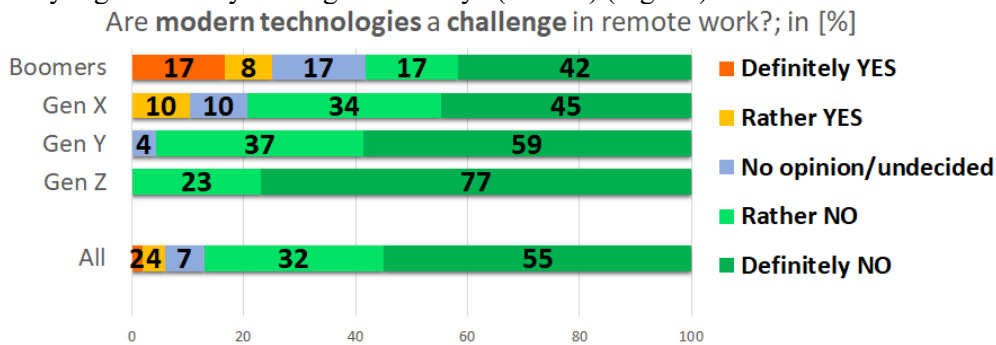

Fig. 15. Answers to the question, "Are modern technologies a challenge in remote work?"

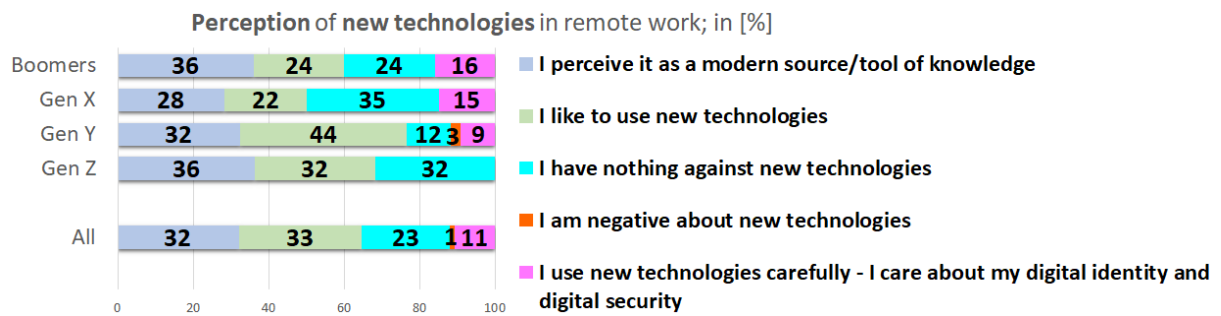**Perception** of **new technologies** in remote work; in [%]

Fig. 16. Perceptions of new technologies in remote work

Factors affecting the change of work/profession/industry after the pandemic

Respondents indicated factors affecting the change of the industry or job after the pandemic. In the overall approach ("All"), "Pay and salary" dominates (27%), followed by "Nothing, I'm not going to change," "Professional burnout, willingness to change and personal development," and "Lack or reduction of jobs in the industry" (all 13%), as well as "Work conditions and interpersonal relationships" (9%). For baby boomers, "Nothing, I'm not going to change" dominates (45%); for the other generations, as in the overall approach ("All"), "Pay and salary" dominate (22% for Gen X, 27% for Gen Y, 41% for Gen Z) (Fig. 17).
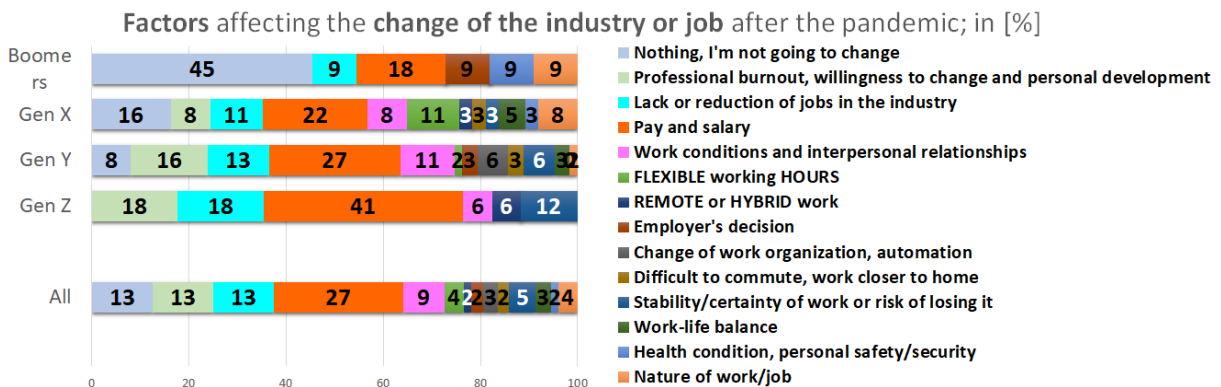

Fig. 17. Factors affecting the change of the industry or job after the pandemic

5. CONCLUSIONS

Due to the complexity of transport issues in the context of activity implementation and mobility planning, the present results of the preliminary (pilot) studies concern the absolutely obligatory activity related to work duties in general terms (i.e., without referring to a specific facility and specific work duties).

It should be clearly noted that the aim of the present research was not to identify and analyze the personal factors examined on the scale of the population of the entire city or other urbanized area. Moreover, the aim of this research was not to generalize these results to the entire population of residents because, in the mobility management process, such research should be carried out individually for specific facilities where specific activities are performed [6]. In that case, the population would be all the employees of a specific researched facility such as a place of work, not the inhabitants of the entire city.

The conclusions from the analysis of the present results also indicate the need to perform in-depth spatio-temporal analyses [33] in order to use time collocation and spatial collocation of people [13, 14]

when introducing virtual activities (e.g., remote work, hybrid work, flexible working hours, working time compression). The following analyses should be employed when developing a mobility plan:

– searching for the **time collocation** of people in order to use remote work (telework), teleconferences, webinars, shopping and Internet services such as e-banking, and remote education

– searching for **spatial collocation**, taking advantage of the **lack of collocation**, applying flexible working hours, and shifting the start or end times of work in neighboring facilities or in the vicinity of transport network elements overloaded during peak hours

– searching for **coexistence** and making, among others, corrections to public transport services by shortening the distance to stops, changing the routes of public transport lines, and adapting the timetable to the start or end times of activities in the facility.

The synergistic factor in these analyses will be the results of research on objective and subjective personal factors of people related to a specific activity, especially in terms of the attitudes of these people toward the virtualization of a specific activity.

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