https://doi.org/10.3311/PPci.20485

Periodica Polytechnica Civil Engineering, 67(2), pp. 357–368, 2023

Development Process of Workplace Mobility Planning in Three Pilot Locations

Domokos Esztergár-Kiss[1*]

[1] Budapest University of Technology and Economics (BME), Faculty of Transportation Engineering and Vehicle Engineering (KJK), Department of Transport Technology and Economics (KTKG), Műegyetem rkp 3.,1111 Budapest, Hungary
[*] Corresponding author, e-mail: esztergar@mail.bme.hu

Received: 18 May 2022, Accepted: 10 January 2023, Published online: 13 January 2023

Abstract

A prospective way to make transportation more sustainable is changing the commuters' travel behavior, which can be realized by creating mobility plans for institutions. A new approach related to workplace mobility planning is developed in three pilot locations in Hungary. As a first step, a roadmap is established including current situation analysis as well as collecting potential measures, setting up a mobility team, and developing pilot actions. The paper presents the planning process taking several aspects, such as commitment, vision, stakeholders' involvement, situation analysis, measure implementation, and recommendations, into account. In the process, several stakeholders are involved to provide useful inputs through online surveys, personal interviews, and focus group meetings. The pilot development process covers three institutions in three locations with such specific parameters as the size of the city, the number of employees, location, and accessibility. As a result, it is seen that most measures aim at cycling infrastructure development, bike fleet introduction, and electric charger deployment. The proposed process is easily transferable and applicable in any location and any institution. The results not only support the commuters but show a potential to serve long-term societal goals, as well.

Keywords

workplace mobility plans, sustainable measures, stakeholder involvement, process development, commuting

1 Introduction

Commuting is a relevant mobility issue considering the travel time and distance. Since it is difficult to change the destination (i.e., workplace), and in many cases, commuting has tight time constraints, it generates typical morning and afternoon peak traffic [1]. Therefore, commuting determines the performance of transportation systems, and solving the problems of commuting can support the mobility-related goals of individuals and institutions.

Traffic management is strongly represented on several levels as indicated by Szele and Kisgyörgy [2]. The main approach of sustainable mobility planning is presented by Banister [3], where several key elements, such as providing a holistic approach, involving stakeholders, and defining suitable measures, are highlighted. Sustainable urban mobility planning (SUMP) is widely applied across Europe; however, the implementation of SUMPs in pilot locations requires specific processes as stated by Kiba-Janiak and Witkowski [4]. The promotion of cycling is a suitable measure to implement as presented by Mátrai et al. [5].

A comprehensive assessment by Arsenio et al. [6] highlights the importance of having a common vision and the stakeholders' participation in the planning process. Furthermore, it is confirmed by Kennedy et al. [7] that SUMPs are expected to contribute to long-term policy goals, but these goals can be reached by realizing suitable measures. Chakhtoura and Pojani [8] address the main questions of sustainable mobility by investigating which kind of indicators should be considered for the evaluation of sustainability. Another study by Myrovali et al. [9] connects data collection with innovations by highlighting the importance of collecting feedback from various stakeholders. It can be seen that a clear set of indicators and well-defined parameters is a crucial part of the planning process confirmed by Seger and Kisgyörgy [10].

A study by Hickman et al. [11] states that among the components of the strategy to reach low-carbon transportation, enhanced travel planning for workplaces and schools with a travel awareness campaign appear. The potential

Cite this article as: Esztergár-Kiss D. "Development Process of Workplace Mobility Planning in Three Pilot Locations", Periodica Polytechnica Civil Engineering, 67(2), pp. 357–368, 2023. https://doi.org/10.3311/PPci.20485

effects of SUMPs are analyzed by Lopez-Ruiz et al. [12], where the workplace travel plans are specifically mentioned as a potential source of emission reduction. However, no detailed process with measure suggestions is developed to support the mobility planning for commuters. As commuting is responsible for transportation-related emissions, providing sustainable and green options is especially important not only for the users but for the society, too. So far, the topic has been handled in general, but this paper provides insights into how to change people's travel behavior when commuting to their workplaces.

2 Literature review

Workplace mobility planning has a lot of similarities with SUMPs, and it merges trending topics of research, such as realizing common planning objectives, applying participatory planning methods, and creating measures to promote sustainable modes as stated by Cairns et al. [13].

Related to common planning, Keserű et al. [14] develop a methodology to realize a common vision about mobility planning with several stakeholders. The paper describes how stakeholders' ideas can be merged; however, the scope of the analyzed areas is wider, and the timeline is longer compared to workplace mobility planning. In another study, Soria-Lara et al. [15] use wild cards, which means that disruptive scenarios are introduced during vision formation to find new approaches to the recurring problems. While this technique could be used when discussing problems related to commuting, the study is too large-scale and long-term since it focuses on land-use and transportation planning in a strategic timeline setting a vision for 2050.

When discussing participatory planning, Le Pira et al. [16] aim to analyze balances in stakeholders' involvement processes since not all participants have the same competence, interest, and power. Although the study does not evaluate the specific role of a workplace, the developed general approach could be used in the process of workplace mobility planning. Carteni et al. [17] develop a decision-making method with stakeholders based on an iterative process, which considers the feasibility of the legislative, planning, technical, and stakeholder aspects. Both studies are developed for larger scale projects compared to workplace mobility plans, while some elements of the method can be applied in current research work.

Further studies focus on finding suitable measures with the aim of reaching a common vision. A relevant analysis by Petrunoff et al. [18] is carried out in Perth, Australia, where health and transportation practitioners share their perspectives on active travel promotion at the workplace. The main result of the paper is that parking management is a key for facilitating behavior change. An article by Kepaptsoglou et al. [19] shows that the measures of quality management work well in mobility management, as well. The approach of the paper is close to the process of workplace mobility planning, but the pilot cases are schools. Duleba [20] designs a ranking process, which is applied to examine public transport services, but it could be transferred to the workplace mobility planning process by setting up a ranking for the measures considering the employees' needs, as well. Furthermore, Sprumont et al. [21] assess the workplace commuting of the University of Luxembourg and provide suggestions to influence mode choice by cycling and walking, using public transport and car-sharing-related measures, such as developing an own bike-sharing system or creating reserved car parking opportunity for carpoolers. Based on these examples, suitable measures can be suggested when creating workplace mobility plans.

In addition, the topic of travel-based multitasking should be considered, where specific indicators, such as age, gender, trip duration, travel mode, trip purpose, timing, and travel companion, are analyzed as in Keseru and Macharis's study [22]. The researchers find that attitude, comfort, and availability are the most relevant aspects to be considered in mobility planning. Similarly, Munkácsy et al. [23] examine travel-based multitasking in case of traveling by public transport services, where household surveys with k-means clustering are conducted. Based on the results, talking, relaxing, and listening to music are the most relevant tasks. Moreover, the choice of suitable transportation modes depends on potential activities, which can be conducted during commuting to the workplace. However, the papers do not suggest any specific measure.

To support the promotion of active modes, a study by Masoumi et al. [24] assesses children's independent mobility to school. The results show that among safety issues, parents' behavior is a strong driver for the children's mode choice highlighting that several aspects have to be considered when choosing suitable measures.

Previous studies discuss sustainable planning on an urbanlevel providing large-scale solutions, where the measures and evaluation tools are well-prepared. Furthermore, commuting and transportation mode choice are discussed together with participatory approaches and the need for involving relevant stakeholders. In addition, some specific aspects of travel-based multitasking are handled, but exact measures are not defined. However, mobility plans

focusing on commuters considering the inputs from different stakeholders and taking the local context into account are not well-elaborated in terms of developing the process and providing the most suitable measures. This means that the methodological steps of the workplace mobility planning process for institutions are missing from the literature. Therefore, current study aims to fill this gap by providing a novel process of workplace mobility planning and by applying it to three pilot locations as a validation of the elaborated method.

The aim of the current paper is to support the creation of workplace mobility plans, which provide sustainable solutions for commuting. The elaborated method contains techniques of the participatory process and defines the steps toward the choice of suitable measures. The steps of the method are based on previous papers related to decision-making processes by Le Pira et al. [16] and Carteni et al. [17] and to the participatory approach by Keserű et al. [14] and Soria-Lara et al. [15] with the aim of including the relevant stakeholders and providing the best measures fitting the local circumstances. The elaborated method is applied in three pilot locations, where the feedback during the demonstrations is used to finetune the process. As a result of applying the method, it is expected to have a list of suitable measures which an institute can realize to initiate changes in travel behavior. Without the proposed method, random and ineffective measures, which do not serve the employees' requirements and are not in line with the employers' willingness, may be implemented.

3 Methodology

3.1 Framework

As a reasonable answer to the challenges of sustainable transportation in the Central European region, MOVECIT project was launched to introduce a new approach in workplace mobility planning (Fig. 1) [25, 26]. The process itself is novel, where the detailed method development and calculation process is included in another publication, but it is strongly connected to the SUMP process [27]. The aim is to realize a more sustainable transportation system in times of growing individual and motorized mobility in city regions. The core approach is that workplace mobility plans are created for institutions; thus, suitable measures can be implemented to change their employees' commuting habits. Campaigns are developed to make cycling, walking, and public transport more popular. At the same time, measures connected to car-sharing, bike-sharing, e-mobility, and improved car-pooling are introduced in the pilot locations.

This model is based on the general SUMP process cycle, which is applied for cities as described by ELTIS [28], and consists of 12 steps, where the most relevant steps are the framework setup, the mobility situation analysis, the measure selection with stakeholders, and the monitoring of the implementation process. In the elaborated method, the process is customized according to the requirements of the institutions and applied for workplace mobility planning instead of city-wide implementations.

The framework supports the development of workplace mobility plans. The process consists of the planning steps, which lead to a set of proposed measures including the exploration of the employer's mobility vision and the analysis of the employees' travel behavior. As a result, the selected pilots can implement workplace mobility plans with suitable measures. In the stakeholders' involvement process, several events are organized to reach a wider acceptance of the plans. The pilot investments aim to increase the employers' commitment, which is supported by communication and promotion activities.

The application of the framework enables the suggestion of the measures in a structured way utilizing the synergies efficiently. Usually, the decision-makers do not have enough information from all stakeholders and about all options; thus, they cannot fully understand the whole context. The framework provides a solution exactly for this problem by taking the employees' requirements, the employers' willingness, and the local circumstances into account. Therefore, the most suitable measures, which build on each other and have a positive effect on the travel behavior, can be chosen.

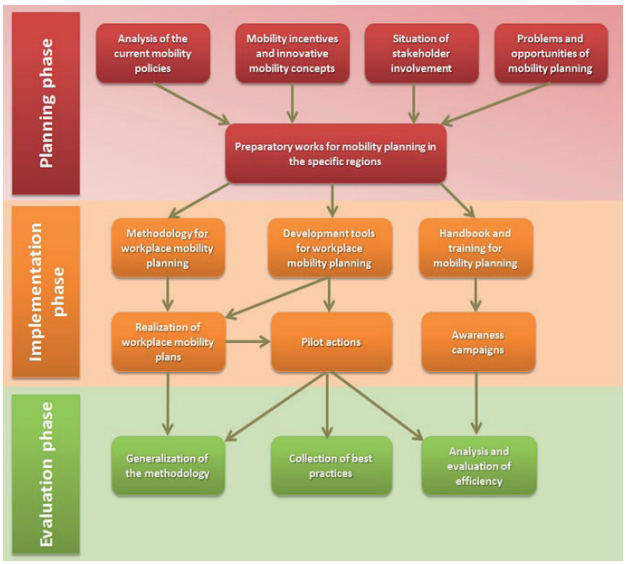

Fig. 1 The roadmap for workplace mobility planning [25, 26]

In order to reach the objectives of workplace mobility planning, a roadmap is established (Fig. 1) with phases such as planning, implementation, and evaluation. Current paper deals with the planning phase with specific emphasis on the workplace mobility planning process. The evaluation phase provides feedback about the most suitable measures and the monitoring of the implemented measures, which is not part of this research.

3.2 Steps of the workplace mobility planning process

The method consists of six steps, which are strongly connected to each other (Fig 2). First, the mobility concept is created along with the vision and development directions. Afterward, the mobility team is set up from different stakeholders to further elaborate the options and discuss the ideas. During the analysis of the current situation, the employees' mobility behavior is measured, interviews with the employers are conducted, and site audits are carried out to receive the necessary input information about the institution. In the next step, the specific measures, which reflect the employees' real needs and the opportunities of the institutions, are elaborated. Afterward, some measures are implemented based on a pilot action considering the financial options and the proposed schedule. Finally, the measures have to be evaluated based on usage statistics and feedback from the employees. In this paper, the first four steps of the workplace mobility planning process are in focus.

3.2.1 Vision and mobility concept

The first step in developing the plan is to create a general vision and a specific mobility concept. This step lasts around 2–3 months. In general, the workplace mobility planning process is driven by mobility planners, who are responsible for the realization of the listed steps.

The vision is a general long-term development plan of the institution including sustainability and mobility-related elements. When creating the vision, several stakeholders have to be involved through discussions, interviews, and workshops, because the transition toward sustainable mobility requires active support from the decision-makers.

A mobility concept describes how to elaborate the workplace mobility plan and how to get the relevant people involved. Furthermore, the concept sets out the goals and the priorities in accordance with the vision of the institute. For the mobility concept, it is essential to have the relevant stakeholders' support and involvement. When it comes to making decisions on the elements of the workplace mobility plan, support from the management of the institution has to be gained because most measures require some funding. To get the relevant decision-makers on board the benefits of the workplace mobility plan have to be highlighted. In the preparation phase of the workplace mobility plan, a concept showing how to elaborate, implement, and evaluate the measures has to be created. It is critical to set up a project plan with goals, milestones, and indicators.

3.2.2 Mobility team

For the development of the workplace mobility plan and the successful implementation of the mobility measures, all involved persons' commitment is needed, and responsibilities have to be assigned. This step requires around one month, but the mobility team works until the end of the whole process. When the workplace mobility plan creation is supported and authorized, it is necessary to assemble a mobility team responsible for the mobility planning process. The team structure should be strong if the participants' competence, interest, and power are considered. Therefore, the members of the group should include a mobility manager (e.g., for general coordination), a facility manager (e.g., supporting the investments), an institutional manager (e.g., informing the decision-makers), a financial manager (e.g., supporting budget-related questions), a communication manager (e.g., informing employees about the measures), internal or external mobility experts (e.g., suggesting suitable measures), and workers of relevant departments or teams. These roles are related only to the planning process.

Fig. 2 The steps of the workplace mobility planning process [25]

3.2.3 Situation analysis

To ensure that the chosen measures promote more sustainable transportation, a clear picture about how employees travel and what facilities or services already exist has to be established. This step requires around 1–2 months to collect all related information. The travel assessment of the employees is carried out by a survey representing the baseline data, from which workplace mobility plan measures are developed. Questionnaires must be easy to fill in and as short as possible with simple questions to maximize the response rate. Incentives for the participants can facilitate the process, as well, but in all cases, the survey should not be too long and complicated. It gives a status of the travel patterns of the employees and collects information on what measures would help in making the employees change their travel habits. Furthermore, regular meetings with the focus groups have to be organized including employees to receive information about their travel patterns in detail, the reasons for mode choice, and the willingness to change. Wild cards can be introduced at employee forums. An example for such wild cards is the following: what could happen if there were no free parking places at the site or in case of any other issue considered against the status quo. A site audit should assess the accessibility of the location by modes of transportation and the existing facilities. The site audit assists in receiving information about realistic alternatives.

3.2.4 Measure suggestion

There is no unique solution to answer all transportation needs as some employees respond to specific measures and others may not react to any. A combination of measures should be introduced to let the employees choose in accordance with their mobility needs. Therefore, the measure suggestion step requires around 1–2 months. The key to a successful workplace mobility plan is to identify those alternatives that the employees are willing to use, hence encouraging modal shift. The basis of developing a realistic package of measures is conducting the travel survey and the focus group meetings. These steps identify those elements mostly supported by the employees and highlight the areas worth focusing on. There should be a balance between the costs and the potential benefits of the measures.

3.2.5 Implementation planning

The key document created in this phase is the action plan. The plan describes the steps of the whole implementation process in detail. Specific goals, targets, responsibilities, financial sources, and measures along with the timeline of the process are included. This step needs around 1–2 months because several interactions are required. The measures are sorted into the following groups: immediate measures, short-term measures, and long-term measures. The timeline of the realization is different for each group. The indicators should be part of the action plan as they help to measure and control success. In addition, the financial issues have to be specifically highlighted, where both the investment and the maintenance costs of the measures should be calculated. As the institutions usually have a limited budget to implement measures, the list of measures provides support for deciding on which one should be implemented first. If more funding is available later, further measures on the list might be realized. In general, the measures of the workplace mobility plans are introduced from the internal funding of the institutions because usually, these are local interventions with relatively low financial requirements.

3.2.6 Evaluation plan

Workplace mobility planning is a dynamic process that can be measured by using a well-defined monitoring plan because the impact of any new measure and policy needs to be checked thoroughly. This step requires around 1–2 months. Monitoring and evaluating the activities deliver data about the impact of the measures that should be carried out before and after the implementation of the measures and should relate to the achievement of the targets.

Monitoring should help to produce new or refined targets and an appropriate campaign to support the achievements. To compare the results properly, monitoring methods should be kept consistent over the timeframe. A cyclical revision is planned in case of the workplace mobility plans based on an annual survey of the employees on their actual mobility habits and demands. During the process, the goals, measures, and implementations should be revised and eventually modified. Some years later, the collected data might be a basis of analyzing longitudinal trends. Moreover, later surveys should pay attention to collecting the users' experience of earlier introduced measures. After this revision, measures should be postponed or taken forward.

4 The application of the method

The theoretical method is applied in a real environment in three pilot locations, where the result is expected to show the suitable measures. Based on the elaborated method,

a comprehensive workplace mobility plan is obtained. This means that the main result provides confirmation that the process works well, and there are adequate results for various local contexts. Moreover, the method eliminates common problems with random and ineffective solutions, such as implementing measures which are not used and accepted by the employees.

The aim of applying the method in pilots is to show the robustness and transferability of the elaborated process in various environments. Therefore, three pilot locations are chosen to support the application of the process in environments having different local features including the size of the city and the number of the employees. For example, in a big city, bike-sharing or car-sharing solutions are usually available, where the measures can be planned to provide free passes for these mobility solutions, but in smaller cities, these options are not available. In the case of a big employer, carpooling solutions are easier to implement because of the relatively high number of employees commuting from the same area, while in case of smaller employers, this solution is not feasible.

The practical experience of the use cases related to every step in the planning process is collected. First, the general commitment and the vision of the institution is evaluated, which is related to the "Mobility concept" step of the process. Afterward, the next step is the "Mobility team" formation, where the representatives of the relevant departments are invited. The stakeholders' involvement and the current situation are discussed by using online surveys, personal interviews, and focus group meetings, which covers the steps of the "Situation analysis". Finally, the chosen measures and recommendations are formulated in the frame of the "Planning measures" step of the process. The experience collected through the creation of measures is listed in the "Outcomes" section.

4.1 Pilot locations

To gain various experience and try the usefulness of the proposed method, different types of pilot cases are selected in Hungary. Three institutions in three locations are chosen based on specific parameters such as the size of the city (i.e., described by its population), the number of the employees, and the accessibility of the location by sustainable modes such as bike and public transport (Table 1).

The first pilot is realized in the city of Békéscsaba located in the South-Eastern part of Hungary. The city has around 60,000 inhabitants with adequate infrastructure and small distances. In terms of geography, there are no hilly parts, and the whole area is relatively flat. Békéscsaba City Hall (BCH) is an institution responsible for local governance with 208 employees. The institution is located in the center of the city, and it is easily accessible by bike due to an excellent cycling network. Public transport stops are nearby, but the level of the service is relatively low.

Table 1 The overview of the pilot locations

Parameter/ Institution	BCH	BME KJK	BKK
the city of the headquarter	Békéscsaba (population: 60 334)	Budapest (population: 1 747 618)	
the number of the employees	208	213	1205
accessibility by bike	very good	good	good
accessibility by public transport	average	good	very good

The other two pilots are realized in the city of Budapest located in the mid-Northern part of Hungary. The city has around 1,750,000 inhabitants and is a busy capital with well-developed infrastructure and several transportation options. In terms of geography, the Danube River divides the city into two parts: Buda and Pest. Buda is partially hilly, while Pest is rather flat. The cycling infrastructure is often fragmented and mix-used with private car traffic.

The Budapest University of Technology and Economics, Faculty of Transportation Engineering and Vehicle Engineering (BME KJK) is the leading higher education institution in the field of mobility with 213 employees. The pilot location is not in the city center, but the public transport offer with a longer walking distance from the stops is still very good in the area. At the same time, cycling opportunities are very good as the university is situated next to a frequently used and well-developed bike path.

The Centre for Budapest Transportation (BKK) is responsible for the operation and development of the public transport in Budapest, where there are 1205 employees. The institution is located in the very center of the city with an excellent availability of the public transport service. Additionally, the cycling network is suitable in the area; however, the traffic is dense, and the air quality is not always satisfactory.

The differences of the locations result in significantly different challenges of the institutions, which has to be considered during the workplace mobility planning process. Therefore, the selected use cases are suitable for fine-tuning the methodology and for validation purposes.

4.2 Commitment

In the city of Békéscsaba a high-level commitment toward sustainability is represented in the Integrated Urban Development Strategy [29] and in the Transport Development Concept [30]. The development strategy sets out general goals for downtown traffic and parking regulation, where the BCH offices are located. The concept of the development addresses a general objective related to the urban quality of life and living standards, which are closely aligned with the goals of the workplace mobility plan. More specifically, BCH is committed to ensure a more sustainable usage of public transport and to favor non-motorized modes of transportation among its employees. During the process, the commitment to cycling became a self-reflecting practice for BCH from a general idea.

Sustainable mobility is a major issue at BME KJK as the promotion of a healthy lifestyle is included in the Institutional Development Plan. The university buildings are close to the city center; therefore, it is important to reduce the external environmental impacts, which can be achieved by promoting environmentally friendly modes of transportation. Because of educational purposes, showing good example to the general public and other institutions is essential. Thus, showcasing environmentally friendly transportation opportunities, which positively affect travel habits, is generally supportable.

BKK is the organizer of public transport services in Budapest and operates the bike-sharing system. Regarding the employees, the institution is highly committed to sustainable modes. The company participates in several EU projects related to SUMPs, whose objectives are in line with the goals of the company. There is commitment toward workplace mobility planning, where the main difference is in the used tools and target groups.

4.3 Vision

Formulating visions during mobility team workshops and other participatory events helps in clearly seeing the long-term objectives and consequently the measures potentially proposed. This step is part of the mobility concept, which aims to explore the common vision of the institute. For every pilot case, three short statements are formulated as visions, where the order acts as a ranking.

For BCH, the vision development is based on a breakdown from the urban development plans and on the conversations during the workplace mobility planning process. The following visions are set up:

1. Strengthening environmentally conscious thinking among the colleagues
2. Introducing sustainable solutions for commuting and business trips
3. Becoming an example for local employers and all citizens

At BME KJK, the visions try to define general goals referring to the specific position of the university as an educational and research center of mobility. The three statements are the followings:

1. Supporting a healthy way of life and proactively handling the employees' commuting problems
2. Showing good example for other institutions and for students
3. Reducing the environmental impact caused by commuting

The vision of BKK as a company is to shape the future of urban mobility with information provision and commitment to sustainable modes of transportation. Thus, it has the following goals set:

1. Maintaining the excellent share of public transport among the employees
2. Providing information on available options and the experience of sustainable choices
3. Motivating the employees internally and externally with testing new types of interventions

4.4 Stakeholders' involvement

During the planning process, a mobility team is formed. The mobility team involves colleagues from BCH, who represent the executive level, the strategy department, and the facility management. The mobility team is supported by external experts, who can bring new ideas, can be provocative, and have a fresh look at the old problems. However, the internal stakeholders are those who have personal experience, can make decisions, and foresee the effectiveness of the measures. A wide-scale forum is held to discuss every opinion about commuting, and every department is represented in this stakeholder meeting. The online survey is an extensive current state and demand analysis, where around 25% of the workers give feedback about their mobility. During focus group meetings, relevant problems and solutions are identified.

At BME KJK, setting up mobility team for the institution where most of the employees have some knowledge about transportation is a convenient task. During the

formation of the mobility team, attention is paid to have a participant providing a financial point of view, one handling technical possibilities, and one from higher decision-making level.

Furthermore, external stakeholders, who help with the issues of facility management, are needed, as well. Finally, the mobility team has a dedicated cyclist as a volunteer member. Of the whole staff, which includes around 210 people, 57 responses are received for the online travel survey. During the process, many employees think of their commuting habits and what would be the way to change them. After personal discussions and brainstorming, some measures are sorted out, and other measures are fine tuned.

In case of BKK, first, the question of how to handle the limitations between the offices is handled. The institution has several locations and a work schedule. During the process, it is realized that the planning should be carried out for one specific location. Afterward, the mobility team is set up. The team involves HR specialists, mobility experts, and an external partner from the facility management. Every major step of the process has an effective contribution from the stakeholders. The internal experts could easily run through the process with the help of the methodology and external experts. With the support of this team, an analysis of the employees' commuting habits is carried out through an online survey and personal meetings. The online survey has 265 responses, which is almost 22% of the staff. Since the dominance of the public transport appears in the functional urban area, all measures consider commuting.

4.5 Situation analysis

Most employees of BCH use either public transport or private cars. Every third colleague commutes by public transport (i.e., local bus service), and the high proportion of pedestrians (16%) is due to the central location of the workplace. 13% for cycling is not a very strong result; therefore, the bicycle ratio should be improved. The modal share reflects the plain topographic conditions, where the bike trips are relatively high compared to the Hungarian average. Considering distances, between 2 to 5 km, the share of bikers is over 30%, between 5 km and 10 km, only 10%, and over 10 km, there is practically no interest in biking. At the same time, the cycling infrastructure is well-developed, not just in the city, but in the functional urban area, as well.

Most employees at BME KJK commute either by public transport or by private car. Pedestrians and cyclists do not add up to even 15%. Since the institution does not provide a company car, private car users commute at their own costs. At the same time, flexible working hours make it possible to avoid the congestion in the city center, and the parking situation is acceptable. With increasing commuting distance, individual traffic has an increasing share, as well, while walking and cycling disappear completely. It would be desirable to reduce the use of individual vehicles in case of commuting shorter than 2 km. Over 10 km commuting distance, which is the distance between the borders of the city and the functional urban area, the share of public transport decreases drastically.

At BKK, the modal split shows very high public transport usage compared to the average values in the city, and there are three main reasons for this. The first is that the employer is responsible for organizing the public transport, so employees are more committed to use public transport. The second reason is that every employee receives free monthly passes. The third important point is the downtown location of the office building with very good public transport links from every point of the city and from the functional urban area, too. At the same time, for private car users, the location is difficult to access. The 10% use of cars is since certain high-level positions are linked with a company car. Significant deviation is only present in the case of short-term journeys, where walking has a high amount. The share of individual car usage is growing steadily with the increase of the travel distance.

4.6 Measures

As a result of the previous steps, BCH proposes six measures in agreement with the mobility team. The majority of the measures are in connection with cycling, which is a strategic point of the institution. Infrastructure development is needed mostly at the endpoints as currently, there is no chance to take a shower or change clothes at the workplace. The buildings have suitable locations for this development, and the intent is to establish a cloakroom and showers with closable storage. A company-owned bike fleet is purchased to serve business trips within the city for those who do not commute by bike. Additionally, this is a test opportunity for workers who currently hesitate on purchasing their own bikes. Improving electromobility is another measure which is in the focus. Electric cars and electric bike charging points are planned to be deployed. Two measures are to decrease private car usage, one with raising an awareness campaign, and the other one is the development of a parking management strategy.

At BME KJK, for a further spread of sustainable transportation modes during commuting, nine measures are proposed. The first measure is purchasing electric rollers because the execution of trips within the campus (from the faculty building to other buildings) is problematic due to the long distances between the university buildings. Some other measures help cycling, for example introducing bike-sharing passes, developing shower facilities in the faculty buildings. Moreover, a long-term development is planned: the introduction of shuttle bus services in and around the campus with self-driving vehicles. On the one hand, this idea requires a lot of innovation and has lots of barriers; on the other hand, it reflects one of the main problems of the campus, namely the public transport stops are relatively far away from the buildings.

Since the current state of the modal share is quite satisfactory at BKK, the measures of the workplace mobility plan primarily concentrate on supporting more activities by bike. The plan contains such measures as the simplification of the bike-sharing usage for employees, an infrastructure development as purchasing bicycle tool kits, and later company owned bike fleet, too. Another measure has a secondary goal beyond encouraging sustainable commuting: building a better workplace community by establishing an innovation lab. The innovation lab is a group of employees who are open to innovative solutions and sustainable transportation. The renewal of the company-owned car fleet helps in reducing the CO2 emission of the company. For both private cars and bikes, electric chargers are planned to be built at the workplace.

As an experience of the planning process, some measures are more related to the facilities (e.g., building bike shelters, e-chargers), and others are more related to the employment (e.g., flexible working hours). The pilot cases turn out to be different in the aspect of facility management. BCH owns and operates their buildings, which is a clear situation in terms of the possibilities. BME KJK has a special case, where the university owns the buildings and has its own facility management, and the faculty has only limited possibilities to initiate changes. The situation of BKK is clear again since the institution rents offices in its headquarters, so BKK neither owns nor operates the building. These learnings create further ideas about how to cope with conflicting interests.

All three pilots are finished before the outbreak of the COVID-19 pandemic, and the main results of the study are found earlier than the pandemic, as well. Since the pandemic, the way how employers and employees think about home office has changed. Although remote working appears as a possible measure during the planning process, it does not turn out as relevant as today. In the after-pandemic era, promoting sustainable modes of commuting is still relevant for those who have to work at their workplaces.

5 Discussion

Applying the workplace mobility planning process in different pilot locations helps to gain experience. At the same time, it can be stated that the pilots serve as the validation of the method showing that the suggested steps of workplace mobility planning provide useful measures with the agreement of various stakeholders.

The main benefit of realizing such a plan is that it takes all options, all stakeholders, all circumstances, and all transportation modes into account. This means that instead of implementing individual measures, a comprehensive solution is provided, where the measures complement each other (e.g., besides a parking management measure, an alternative is provided to support active transportation modes). For example, if the organization deploys only a new bike rack because of an individual employee's request, the workplace mobility plan considers the requirements of the employees, the employers, and the local context; thus, besides the bike rack, a charging point for electric bikes is deployed within the same infrastructural development step, as well. Therefore, more employees benefit from the implemented measures in a cost and time efficient way.

A main outcome is that the process of the elaborated workplace mobility plan runs smoothly in three different pilot locations, where different organizational structures, stakeholders, requirements, and opinions are found, yet it is possible to suggest suitable and relevant measures in all cases. For example, in BCH, coordinated cycling-related measures are advised, which is beneficial considering the employees' requirements and the employers' willingness.

Based on the pilot participants' feedback, the method is sound and useful considering the local context. Without applying the method, it would not be possible to identify the most suitable measures for the pilot locations. By providing suitable measures, there is a higher chance on the commuters' side to change their travel behavior because such measures are implemented that are requested by the employees. In addition, the employers are more supportive of realizing these measures since they are in line with their visions and consider the local circumstances.

The method presented in this paper is a version updated based on the experience with the pilots. The main feedback from the pilots was that the ideal composition of people who should be part of the mobility team should be included in the method. Originally, especially for BCH, it was not clear who should be delegated to the mobility team. Otherwise, during the process, there were no extreme differences among the pilot locations.

A part of this experience has already been implemented in the method. For example, using wild cards during the employee forum turned out to be very effective. Other parts of the gained experience generate further topics for research, such as setting up direct connections between the collected data and the suggested measures.

Regarding the limitation of the study, every pilot location has some kind of connection to mobility. BKK and BME KJK have transportation professionals as employees, and BCH has some colleagues dealing with transportation-related issues, too. This situation helps in reaching early engagement in the topic, but efforts are made to reduce this effect during the planning process. As an example, in every mobility team which has a significant role in the method, non-mobility-experts are members of the group, as well.

The project does not include business trips, but it is a relevant topic; thus, it has to be fully covered in further extensions of the workplace mobility planning method. The work-related business trips can be categorized as local trips within the city and external trips, which can be national or international. The types of available transportation modes, the options to reduce emission, and the potentially suitable measures are different in both cases.

While individual workplace mobility plans only affect specific workplaces, dissemination and the proper use of the approach to many workplaces could have a positive effect on urban level through the promotion of sustainable transportation modes. Based on the collected theoretical and practical knowledge, policies and strategies can be set up to provide effective assistance for those institutions willing to move toward sustainability.

6 Conclusions

In this paper, the process of workplace mobility planning is applied in three pilot locations. A main innovative element of the method is that it takes the employees' requirements, their mobility-related goals, and the local circumstances at the pilot sites into account. The result of the method is a set of suitable measures suggested to be implemented by the participating institutions. The method consists of six steps, which are strongly connected to each other. First, the general commitment and the visions of the institutions are assessed. Afterward, through the stakeholders' involvement, the current situation is analyzed by using online surveys, personal interviews, and focus group meetings. Finally, the chosen measures are formulated. By applying the method, such measures are suggested that facilitate the changes toward the employees' sustainable travel behavior.

The evaluation covers three institutions in three pilot locations with specific parameters, where all three locations follow the steps of the process. As a result, in BCH, the biggest emphasis is put on the development of the cycling infrastructure and electromobility with the stakeholders' intensive involvement from different areas. In the case of BME KJK, an extensive data collection is realized with several meetings, which results in innovative measures, such as introducing electric rollers, bike-sharing for business, and a bus service. For BKK, the measures are connected with other initiatives of the institution. For example, an innovation lab, a renewed bike fleet, and electric chargers are the most relevant implementations.

Based on the results of the pilot locations, it can be stated that the measures aligned with a higher-level development plan are well-appreciated by the employers, while small measures serving employees' direct requests are successful among everyday commuters. The method considers several aspects and stakeholders; thus, it can provide tailored suggestions for several different cases. Therefore, the process can be applied in any European city both for smaller and larger institutions. The outcomes not only provide useful interventions for specific workplaces, but in case of wide application, it can potentially facilitate a shift toward sustainable transportation modes among the commuters, which would be a real benefit for both cities and citizens.

Acknowledgement

The paper was prepared within CE25 MOVECIT project, which is supported by Interreg CENTRAL EUROPE Programme funded under the European Regional Development Fund, co-financed by the European Union and the Hungarian State.

The research reported in this paper is part of project no. BME-NVA-02, implemented with the support provided by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the TKP2021 funding scheme.

The linguistic revision of current article is prepared by Eszter Tóth.

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