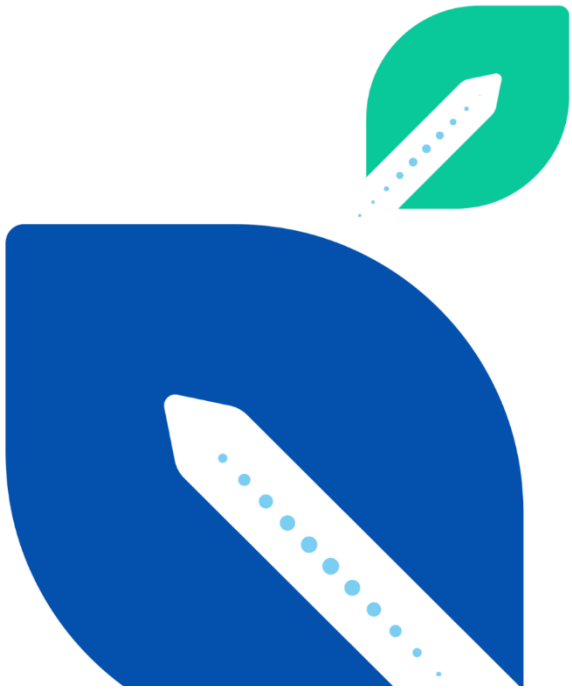
D4.7 Impact assessment and city-specific policy response

Kalisz pilot



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Executive summary

The purpose of the pilot was an attempt to regulate and minimize cargo traffic in the City centre of Kalisz and capture information about the real flows based on the implementation of the IoT (sensored) bays.

The aim of the solution is to enable planning and booking of the reloading spaces. It is assumed that the planned reloading operation would allow the trucks to go directly to the booked place at the specific time, park and reload close to the designated place, reducing the load from delivery vehicle traffic.

The installed system included sensors, communication devices and base station. Additionally, a dedicated application was developed. Both the sensory network and the application were preliminarily tested, implemented, and tested again in the form of a living laboratory in the centre of Kalisz City.

The data collected from the system database and from two conducted surveys, pre- and post-pilot, provided information on truck traffic in the city centre and also on the behaviour and preferences of the stakeholders. The main findings include:

- 40% of reloading operations were within a very short time slot,
- increased illegal parking activity outside the designated spaces,
- avoidance of parking fees.

One of the results is the assessment of technical solution (base station, application, sensors). The tested sensors haven't met the test site requirements, probably because of heavy weather conditions. Whereas, the application, communication, and base station tests were finalized with a positive response, which means the solution is ready for future development or installation in different cities.
The main recommendations after the pilot includes:

- introduction of the change of truck parking charging method towards subscription instead of fees,
- enabling of the reloading bays for temporary parking of private cars during night hours and at weekends.

The proposed regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days with subscriptions might be the best supporting policy for scaling the mobility solution to other locations within the city boundaries. The procurement process needs to identify the sensors with adequate technical requirements that are more appropriate for Kalisz humidity and cold winter and include some spare parts stock. Weight and/or size restrictions for delivery vehicles being introduced gradually may help to create more socially acceptable environment while reducing stakeholders' opposition. The city should increase the efforts for awareness raising towards urban mobility and its social and environmental consequences, building the knowledge gap and proceed with ICT developments. The support with other policy measures such as provision of inner-city micro-consolidation centres is

needed for the logistics infrastructure. In the short term, a project pilot with the support from an experienced company may help to overcome these barriers. Finally, environmental criteria in public delivery contracts might not be an appropriate policy measure in the short run. The benefits are hard to quantify and the number of infeasibilities found in a study may represent a difficult barrier. Once the city improves last-mile efficiency perception and awareness of stakeholders through education programmes and dissemination, environmental criteria in public delivery contracts can be revisited and assessed again.

1 Introduction

1.1 Aim of the deliverable

The deliverable aims to explain the work and results of testing and assessing the pilot's mobility solutions, identify a list of alternative policy responses according to the stakeholders' objectives and users' needs, and define the final city-specific policy response. The work consists of three steps. The first step was the implementation and assessment of the mobility solution. The barriers and problems found together with the sustainability assessment were the basis for the sequential steps and the definition of the city-led policy. By the time the second step started, the city of Kalisz was able to find only one problem for the use case. Based on the Stakeholders Based Impact Scoring (SIS) methodology, the pilot identified the veto stakeholders, found their objects and showed the trade-offs all stakeholders have to make. In the last step, Kalisz identified a list of alternative policy responses to enhance the mobility solution adoption, scalability and transferability. Finally, the pilot assessed the alternative policy responses implementation and user acceptance and defined the policy measures that harness the implementation of Kalisz innovative mobility solution.

1.2 How this deliverable relates to other deliverables

The development of the task considered previous SPROUT work. More specifically, the pilot followed the steps and methods reported in D4.7 COVID-19 disruptions and other challenges encountered during the pilot implementation forced to adjust the initial set-up as explained in this document. The list of alternative policies identified in D3.3 was essential for identifying alternative policy responses and defining the city-specific policy response. This deliverable and the rest of the pilots' reports (D4.3, D4.5, D4.9 and D4.11) will be the foundation for defining the policy implementation messages in D4.14 and the urban policy system dynamics model in D5.2.

1.3 Task participants and sharing of contribution

L-ILiM, as Polish pilot leader, was responsible for the development and validation of the concept of introducing a digital mobility solution for improving the organization and management of the loading / unloading operations in the city centre of Kalisz. The concept was based on implementing a sensor network using Internet of Things (IoT) technology, which enabled the access to transport data in real-time. Main tasks provided by L-ILIM comprised of a research study aiming at identifying optimal locations of reloading bays to be further equipped with sensors. Next, the technical development of application for planning and booking of unloading operations and the development of technological solution based on sensor network, including tests, technical concepts, organization of installation, and actual support during operation. After implementation of the system technical support including the troubleshooting, verification of malfunctions, and spare part installation were required. Finally, data collection and analyses for preparation of a report and formulation of the policies, in cooperation with other partners, were carried out.

City Hall Kalisz was responsible, among other things, for obtaining necessary permits, preparation of marking of all bays with traffic signs, formal agreement with the relevant municipal services, including the process of obtaining permits to place the base station on the historic building of the Kalisz town hall, including the consent of the conservator of monuments, then support during the equipment installation, especially of the base station installed on the town hall tower (access to the facility) and support during system testing period within its maintenance. Moreover, analyses of data, collected by the implemented system, from the city point of view and support in defining future regulations in terms of urban mobility were provided.

Tasks of Kalisz Business Incubator included organizational and marketing support of the implementation, collection of data from local stakeholders for the research conducted to select the optimal locations of intelligent unloading bays, information exchange between project partners and stakeholders, preparation and distribution of leaflets for drivers and deliveries recipients, and, finally, dissemination of information about the system operation. The Incubator's relationship with the local business community and the resulting support was very useful.

1.4 Structure of the deliverable

The deliverable is structured as follows:

- Chapter 2: Pilot activity description
- Chapter 3: T4.3 sustainability assessment
- Chapter 4: T4.4 Formulation and prioritization of alternative policy responses
- Chapter 5: T4.5 City-specific policies for harnessing the impact of new mobility solutions
- Chapter 6: Summary and Outlook
- Annexes

2 Pilot activity description

Within Kalisz pilot, a concept of introducing a digital mobility solution for improving the organization and management of the loading/ unloading operations in the city centre was developed and validated.

The concept was based on implementing a sensor network using Internet of Things (IoT) technology, which enables access to transport data in real-time, and the dynamic management of unloading operations in the city. The target users were urban freight transport drivers who were able to book a reloading bay by installing an application in their mobile phones, which provides the interface between the users and the IoT management system.

The implemented solution enabled the trucks to go directly to the booked place at the specific time, and park and reload close to the designated place. It resulted in the reduction of unnecessary truck traffic and manoeuvring, and growing safety for pedestrians and other drives during the whole transport operation.

Figure 1. Roadside sign at the sensored bay with project info

The full description of the solution implementation was presented in D4.6: Set-up Report KALISZ.

During last year, the pilot in Kalisz focused on implementing the WP4 tasks further described in this deliverable. Despite the continuous disruptions caused by COVID-19 and other challenges identified during the pilot demonstration, Kalisz completed all the activities and found meaningful insights and learnings and the process to consider when adopting this mobility solution. Table 2 shows the updated Gantt. Finally, T4.5 initiated in M22 concluded Kalisz WP4 activities in M25, leading to the Kalisz city policy response.

3 T4.3 Sustainability assessment of the pilots impacts

3.1 Introduction

By the time T4.3 started, three sensors, dedicated only for Sprout application, and the mobile application were available. Parking on sensored bays was not allowed without booking. Figure 2 shows the sensors installed in three streets. Only on Saint Stanisław street there was an existing bay dedicated for loading / unloading urban freight operations before installing the sensors.

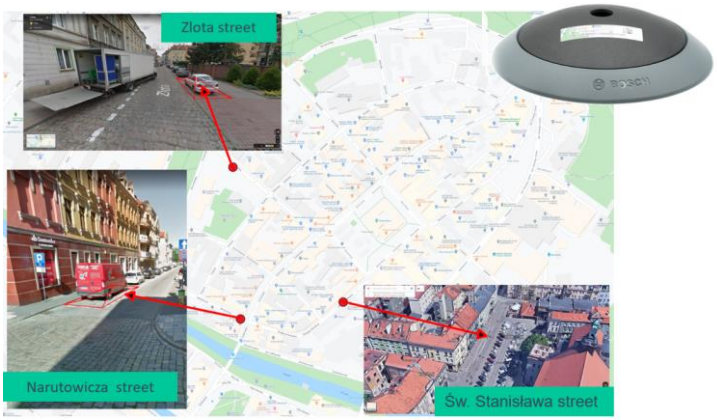

Figure 2. Kalisz Pilot IoT sensors locations (left)

The sensors were connected, via the base station, to the server, which exchanged information with application on Android smartphones (Figure 3). The application was available on the Google Play store, called Sprout. More information about the technical requirements of the pilot demonstration i.e. locations selection, IoT installation, and procedure of system operation can be found in D4.6: Set-up Report KALISZ.

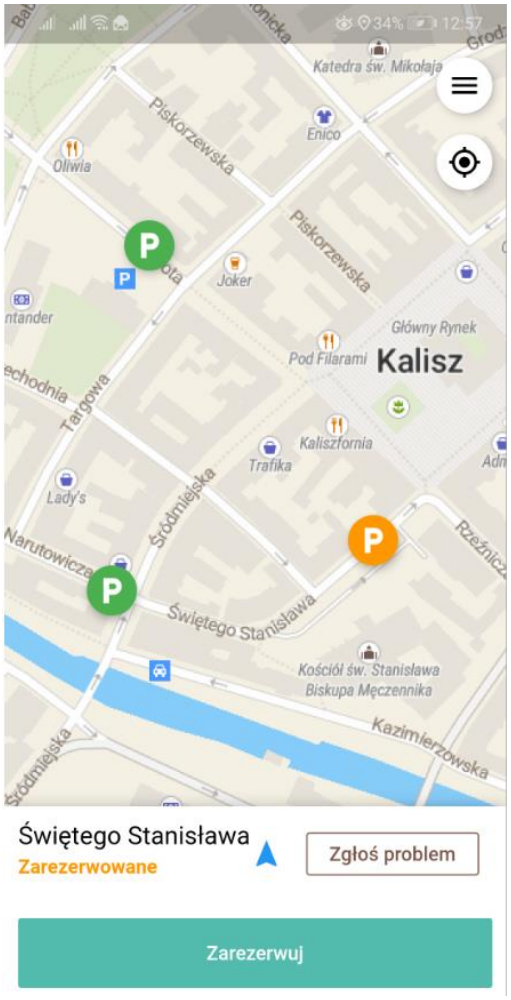

Figure 3. Example screen of application Sprout.

It is fundamental to outline that during the preparing phase (D4.6), the pilot in Kalisz conducted a complete study gaining an insight on the current demand for urban freight deliveries and find the best locations for the sensors. Indeed, due to the lack of previous urban freight data, this preliminary study served as the baseline scenario.

3.2 Kalisz IoT solution business model

The Business Model Canvas was followed as a quite straightforward methodology for visualising the business model that was tested by the Kalisz pilot and simplify its understanding by any interested party (Table 1). More specifically, the following Table presents a) the key partners involved (Sprout project partners), the resources required, the customer segments and dissemination/ communication channels; b) the value proposition of the tested measure, the key activities for deploying the business model and the customers relationships; c) the cost structure and potential revenue streams. Each Canvas section is further analysed in the following subsections.

Table 1. Business model based on Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
- City of Kalisz - Kalisz Business Incubator - Ł-ILiM - SPROUT consortium members	- Permissions - Design - Pilot implementation - Tests / living laboratory - Feedback **Key Resources** - Equipment (sensors, base station) - Application - Road infrastructure	- Shortened time for empty bays finding - Reduction of wasted time for travel - Benefits for residents, eg.: less traffic, less noise, less pollution - Benefits for the City: cargo traffic data, regulation, improving the charging system	- Direct information to potential users and stakeholders **Channels** - Direct leaflet distribution - Interviews during research activities	- Drivers - Last mile operators - Other suppliers of deliveries

Cost Structure	Revenue Streams
- Initial expenditure (design, permissions, hardware, software, installation) - Ongoing system maintenance costs	- No direct financial revenues in pilot test model were achieved - Potential revenue to be achieved after implementation of proposed policies

3.2.1 Value proposition

In addition to the expected impacts defined in the Canvas business model, the new business model aims to achieve the following specific measurable goals:

- Reach a 30% of cargo delivered by using the app (I411)
- Reduce the delivery time (20%) (I401)
- Reduce road traffic congestion (10%) (I402)
- Increase the level of perceived safety

3.2.2 Key resources

Table 1 shows the resources required for implementing the pilot. They include sensors spare parts which played an essential role in this pilot as described in section 3.4.5.

3.2.3 Channels

The dissemination plan is essential when introducing a new business model. The application and connection details were disseminated through dedicated leaflets (see Figure 4) distributed as well as on description tables, shown on Figure 1, placed under road parking signs.

Figure 4. Face and reverse of the leaflet (in Polish) with link to application

The distribution of leaflets that were introducing the solution, the advantages for the users and the information about the project took place twice through personal contact of all the shops, stores and other points of deliveries connected with the bays. The first distribution phase was implemented before the official start of the application (October 2020) and after the technical tests and modifications. The second distribution phase (December 2020) was carried out during the pilot's run in order to strengthen the exploitation and dissemination of the tested measure. It should be noted here that at most delivery points the leaflets from the first distribution edition were still available to drivers during the second distribution edition. Thus, full information was available at delivery points throughout the entire pilot conduction.

The interview surveys, pre- and post-pilot, during the research activities were essential to define the baseline and the results of the testing phase.

3.3 Policy framework

As already described in D4.6 Set-up Report, the main objectives and obligations arising from the Development Strategy of the City of Kalisz for the period 2014-2024, which fit into the PGN (low emission management plan) was taken into consideration.

Within the framework of the agreed objectives, particular measures and support need to be provided above all for infrastructure projects that aim at improving the state of roads and air protection, particularly in the areas where acceptable concentrations of pollution are exceeded.

In terms of transport infrastructure, it is proposed to limit the negative influence of transport on the natural and living conditions, which is directly addressed by the loading bay sensoring

project, which proposes a preliminary management system for freight transport operations and provide some rough statistics on the amount of freight traffic in the city centre[1].

The consequences of the transportation problems in the downtown of Kalisz and solutions proposed constituted the subject for further expertise and observation of adaptation of solutions commonly applied in Polish and Western European cities to the local conditions of Kalisz. In the case of Sprout pilot innovative solution based on IoT technology has been tested.

Before the project implementation, there were already loading bays in Kalisz. The rules and regulations of using them have not changed - a driver occupying a bay was obliged to pay a fee in a parking machine. As this obligation requires additional time and money, it is frequently avoided. Parking zone control is not so common to convince drivers to pay for parking, especially as in most cases the unloading operation takes only a few minutes. In addition, some drivers, mainly couriers confirmed lack of allocated budget for parking fees.

It has been also observed that the drivers that need 2-3 minutes to unload preferred to park in prohibited places or places designated for passenger cars. In this way, they minimized the reloading time at the expense of safety, even under threat of a fine. This phenomenon has significantly influenced the project results because some reloading operation were made away from the bays and as such were not recorded by the sensors. It is difficult to estimate the scale of reloading operations at unauthorized sites. This is a value that is not covered by the pilot statistics.

The reloading bays are fully designated to cargo traffic. The passenger cars are not allowed to park there. But during the night hours, there are no deliveries and parking zone control is not active and passenger cars drivers use bays for parking. Because of that it is recommended to adjust the current regulations towards its availability for passenger cars beyond the cargo traffic hours that occurs between 6 am to 6 pm.

3.4 Testing and data collection activities

3.4.1 Stakeholders involved

We assume “project stakeholders” the individuals or entities not involved in the project as partners but being to some extent affected positively or negatively by the project results.

In the case of Kalisz pilot, the stakeholders mainly consisted of local businesses including shops, convenience stores, pharmacies, drugstores that are deliveries customers and suppliers. Bars and restaurants were either entirely closed or limited exclusively to take-aways because of pandemic. Additionally, residents and people working and spending time in the city centre, and the city council were initially assumed project stakeholders but because of pandemic they have not been much affected with lower traffic, noise and pollution because of its predominant absence. The solution was tested on the first group of stakeholders so called

[1] Above part based on *Plan Gospodarki Niskoemisyjnej dla Miasta Kalisza* https://bip.kalisz.pl/uchwaly/2017_34_450.pdf

"local businesses" as well as companies servicing deliveries, and these stakeholders were asked to assess the impact of the solution.

3.4.2 Preparation of the field operational tests and data collection activities

Resources required during the testing period were much lower comparing to the ones needed for preparation of implementation phase (reported in D4.6). The set-up of the system required many people's attention, including:

- application preparation, tests, verification and support,
- selection of appropriate sensors on the basis of various solution tests,
- laboratory tests,
- permits of the equipment installation and bays creation,
- design of installations,
- order of required equipment,
- physical installation,
- measurements of the effective range of the installed base station,
- test of installed equipment.

An indicative operational calendar is presented in the table Table 2.

Table 2. Steps of pilot's technical preparation

Kalisz pilot activities	01.2020	02.2020	03.2020	04.2020	05.2020	06.2020	07.2020	08.2020	09.2020	10.2020	11.2020	12.2020	01.2021	02.2021	03.2021	04.2021
Month of the project	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
selection of appropriate sensors on the basis of various solution tests																
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test of installed equipment																
the living lab																

3.4.3 Field operational test and data collection phase

After implementation, the time was mainly dedicated to monitoring of the statistics recorded by the system. Additionally, some disturbances of diverse nature appeared due to low battery, humidity, or malfunction warnings causing inability of data recording. Any situations that may cause lack of direct communication with the sensor require immediate reactions, and should be the relevant subject to be necessarily solved in possible future implementations.

The collection of data started end of September 2020 and was summarized end of March 2021. The archived data included information about users (phone number, data of account creation, information about data confirmation), bookings (id, start time, length, date/time of creation, place id, user id, information about confirmation and deletion) and real bay occupation (place id/name, status, date and time of sensor status change – details see Table 3).

Table 3. Occupation database example

Name	Occupied	Event time
Złota	1	2020-12-01 05:16:22.352785+00
Złota		2020-12-01 05:20:41.26988+00
Złota	1	2020-12-01 07:23:53.014156+00
Złota		2020-12-01 07:32:36.424904+00
Świętego Stanisława		2020-12-01 07:40:37.015695+00
Świętego Stanisława		2020-12-01 07:41:40.328364+00
Złota		2020-12-01 07:59:36.582549+00
Świętego Stanisława	1	2020-12-01 08:07:42.915691+00
Świętego Stanisława		2020-12-01 08:11:52.660832+00
Świętego Stanisława		2020-12-01 08:11:59.881878+00
Złota	1	2020-12-01 10:08:26.201619+00

It is not easy to state whether a four-month period is sufficient to evaluate the solution, especially given the limited actions in terms of freight operations caused by pandemic period, the limited scale of the implementation as well as the technical constraints resulting from the use of physical infrastructure. It should be assumed the users of the system should be given time to learn about its functionality and get used to it. The pilot installation operated for a relatively short period of time and under unique conditions and limited scope. People often need some time to get used to such solutions. Drivers basically adopted the new bays immediately but were not convinced by the common use of the application.

3.4.4 Impact of COVID-19 for running the field operational tests and collecting data

Transport volume limitations due to lock-down were undoubtedly important. During the testing period of the solution, restaurants and bars, one of the main supply customers in the city centre, were operating on takeaway basis or were entirely closed, which definitely reduced the volume of deliveries. Also, restrictions, both formal and non-formal, negatively affected the number of visitors and stores turnovers. The convenience stores suffered the decrease of the city centre visitors the least. It is difficult to determine the magnitude of this, but COVID-19 constraints certainly had a significant, negative impact on project performance and its results.

3.4.5 Other challenges for running the field operational tests and collecting data

The start of the pilot was slightly postponed because of the technical problems with the base station connection to the Internet that was a necessary condition for exchanging of information.

The preferred wire access offered by the City Hall was impossible to be correctly configured. It was then decided to connect wirelessly by Long Term Evolution (LTE) modem. The process of delivery and installation of the modem consumed additional time, which forced the prolongation of the tests to the end of February.

The next technical issue was related to the selection of the most appropriate sensors. Laboratory testing's with different types of sensors were implemented in order the optimal sensors to be identified taken their performance in terms of compatibility and connection with the base station. Further problems with the sensors aroused after their installation on the parking surface. The sensors did not provide information about deviations – only during the parking operations the cars changed sensors status and made them communicate via the base station to the server providing status information in real time. It was not possible to get the status of a sensor as such and be informed automatically if it was operating, without changing the status: occupied or not. To benefit from the system, it is necessary to be informed about the absence of a sensor as soon as possible and send an alert to physically verify whether it is operating. As it was not in the scope of functionality of the application which should be assumed as a relevant "lesson learned".

Figure 5. Remains of a mechanically damaged sensor on the surface of the bay (Narutowicza Street)

Thirdly, among the installed sensors, one was mechanically destroyed. It was probably made during snow removal or by heavy construction equipment (e.g. excavator, bulldozer) during the modernization of the neighbouring street (see Figure 5). The other one stopped working and was replaced. When it was opened moisture inside was identify (see Figure 6), what probably caused the failure of the electronics. The unsealing of the sensor was most probably caused by a wheel that ran over it during heavy rain or snowmelt. However, the sensor had no signs of mechanical damage and was installed in a place where rainwater does not accumulate.

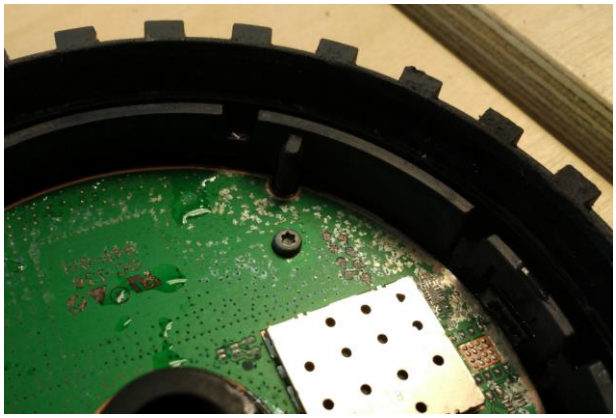


Figure 6. Moisture inside the defective sensor (initially located on Złota Street)

Sensors' damages resulted in time-limited testing in some of the bays. One of the damaged sensors (Złota Street) was replaced with a spare one. Due to the limited number of spare sensors, the mechanically damaged sensor was not replaced. This resulted in a lack of full availability of the sensors for the entire duration of the tests, which was taken into account during the bay utilization analyses.

Another limitation of the testing of one of the bays was the renovation of a neighbouring street, which was scheduled to be completed till the planned tests began. However, the street reconstruction took longer than anticipated and the street on which the sensor was installed was partially closed. It was possible to use the bay, but the access was limited. For these reasons, a comparability of the operations of all sensors and the use of the bays during the same period was slightly reduced.

Pandemic had a significant negative impact on the implementation. Firstly, the installation of the equipment had some constraints, including the arrangements with the installation company and coordination it with the City Hall (the base station was installed on the tower of the City Hall). Secondly, the introduction of the system information campaign was limited to leaflet distribution at delivery points, due to constraints on the organization of meetings with stakeholders that was initially planned. Finally, the direct visits to the locations using the unloading bays appeared to be the most appropriate. Thirdly, the pandemic restriction caused some commercial and service companies to limit their operations or even close them entirely (e.i. restaurants and bars), which seriously reduced the range of the whole research.

Finally, the real testing period, calculated from the day of dissemination of the information about application start (distribution of the leaflets for drivers), was 1 November 2020. The final data was collected from the server end of February 2021, which closed the testing period for a full four months.

The consequences of the above-mentioned challenges and constraints as well as the analysis of data are presented in the next chapters.

3.5 Impact assessment

Generally, two main sources of data were used for assessing the performance of the measure and its acceptance by the city's ecosystem: the data collected from the testing of the system and data collected through a survey for capturing the stakeholders' and potential users' feedback.

a) Data from the system

The pilot system has collected all data from the sensors, more precisely, information on the time of change of the sensor statuses. Every occupancy and availability of the parking bay was transmitted to the database and was available in the application. Such information made it possible to prepare the statistics assumed in the set-up report and described below to compare them with the baseline information described in the set-up report. The application provided information on the operations performed by users. Data from the system are stored in an internal server with raw information. The analysis and calculations were prepared in MS Office tools in the standard way. The assumptions of data analysis were compared with preliminary survey results.

The constraints on sensor availability and the renovation of one of the streets meant that not all sensors were available throughout the pilot period. The analysis periods were therefore subject to variation and adjusted according to data availability in order to reliably present the project results. However, all data (apart from the survey data) was obtained during the pilot period.

The data obtained from exclusively the part of the city with reloading bays available enables to scale–up the results on the whole centre area of Kalisz. The pilot area was located in the city centre and the bays were located in a similar way as the whole reloading bays system. This has made it possible to approximate freight traffic throughout the centre, although not without significant distortions - the system does not allow the identification of vehicles that stop repeatedly and treats each stop as an activity, not as a separate vehicle. The statistics, therefore, are related to the *number of operations, not the number of vehicles*. It is only possible to determine the number of vehicles by assuming an average number of stops for a given vehicle in the city centre.

b) Stakeholders' survey

In order to further enrich the data collection process and capture the behaviour and impressions of the city's stakeholders on the measure, dedicated interviews and surveys were implemented. It gave the approximation of the project results from the perspective of stakeholders. The second survey was conducted after collecting the data from the system to obtain information on the additional KPIs, not provided from the system database. The interviews (an example of the completed questionnaire in Polish is presented in the annex) were conducted in the middle of March 2021 with all the groups of stakeholders, in particular direct system beneficiaries: drivers, deliveries destinations' representatives and citizens. Responses were collected over about a week in the form of face-to-face interviews and, due to the pandemic threat, exchanging questionnaires and responses electronically.

The main objective of the study was to obtain information for preparing an impact assessment of the solution, which cannot be calculated on the basis of data from the sensor system. The next objective was to confront the results of the study before and after the implementation of the pilot study. The survey results enabled verification of the project execution from the stakeholders' point of view (section 3.4.1).

3.5.1 Outcomes

According to the data obtained, the new bays (Złota and Narutowicza Streets) occupation rate was confronted with existing one (Św. Stanisława Street). The details are shown in Figure 7 for the period when all three bays were operating in parallel. The most occupied days were weekdays with **8 to 10 occupations**. The occupation of the new bays is 62% (Narutowicza) and 75% (Złota) of the Św. Stanisława street. It means that the location of the new bays was well planned because the target level of 50% was exceeded (68% occupation rate).

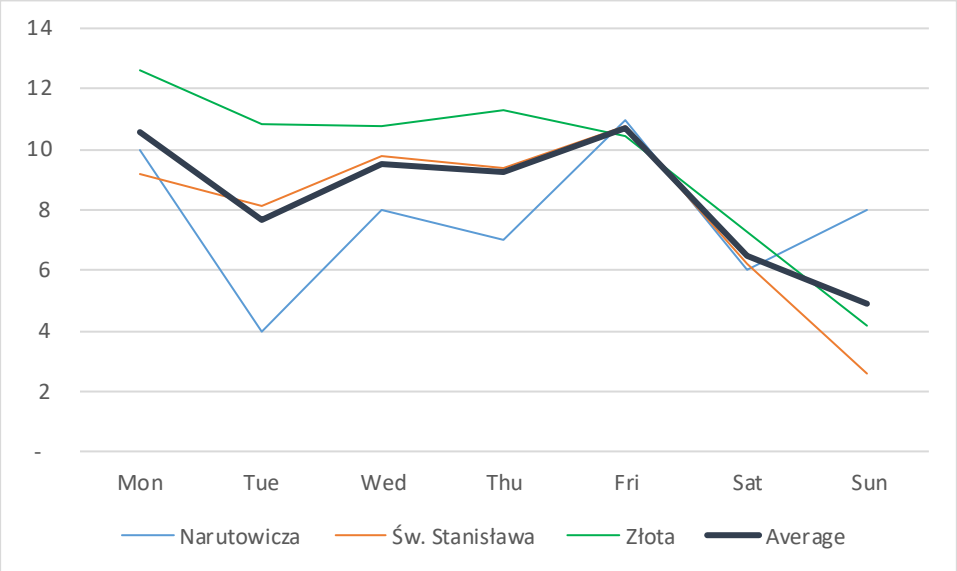


Figure 7. Average daily occupations of the bays

Deliveries are therefore most frequent on Mondays and Fridays and least frequent on Tuesdays. Comparison with a pre-pilot survey (see Figure 8) shows the small difference between the user opinion and measured reality. The overestimation of Tuesdays by respondents is noteworthy. One of the reasons for quite huge share of weekend occupations can be cars parking on the bays during the night hours.

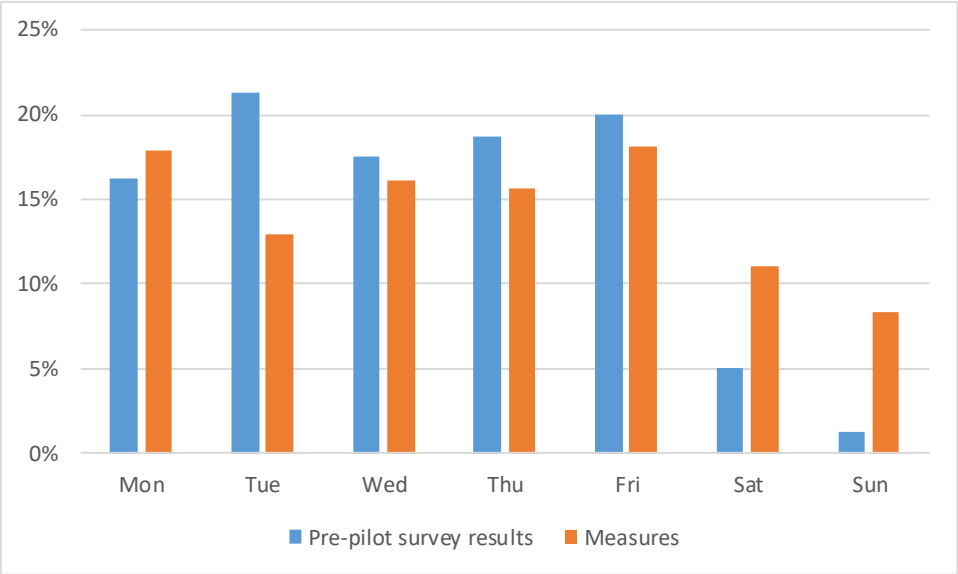


Figure 8. Average daily occupations – declaration versus measures

The **most occupied hours** are shown in Figure 9. The busiest ones are **from 7:00 till 16:00 (9 hours)**, when 77% of reloadings take place. There was a strong dissonance between the scale of operations in the survey respondents' declarations and the results of the pilot around noon.

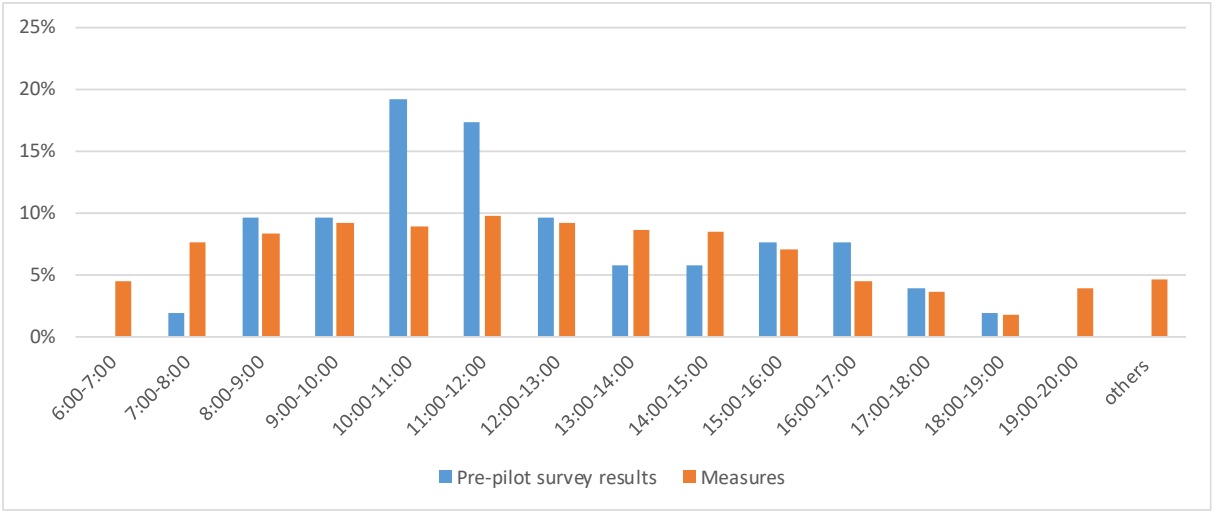


Figure 9. Daytime of bays occupation

It is worth noticing that the significant number of operations between 19:00 and 20:00 is due to parking in just one bay at similar times, presumably by residents. Similar results give the time split of booking hours, but with the gap in the middle of the day (Figure 10).

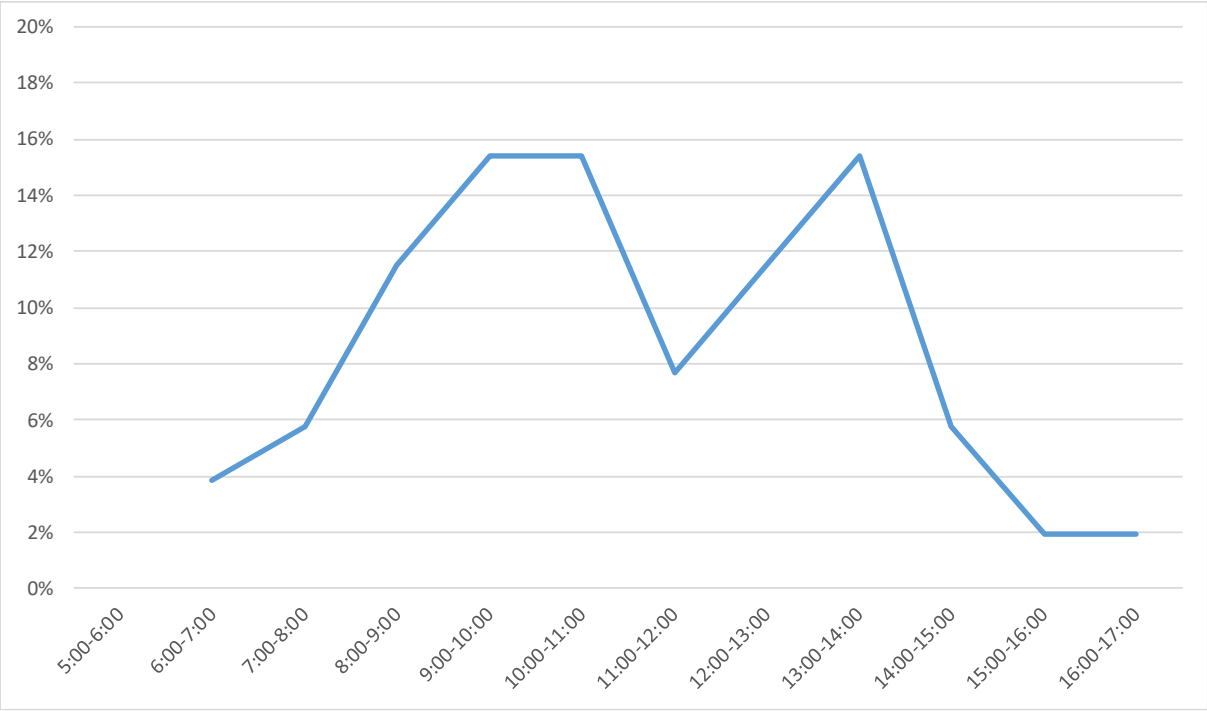


Figure 10. Time split of bookings

The **time of reloading** operation can be calculated from the available database – see Figure 11. Close to ***40%*** of operations last **shorter than 5 minutes** (half of it even shorter than 3 minutes). And this is one of the crucial results of the project. *The reloading time is shorter than the time connected with paying for parking and a little bit longer, than booking the bay in Sprout application*. That is the reason, drivers decide to avoid parking fees – short parking time means low risk of penalty.

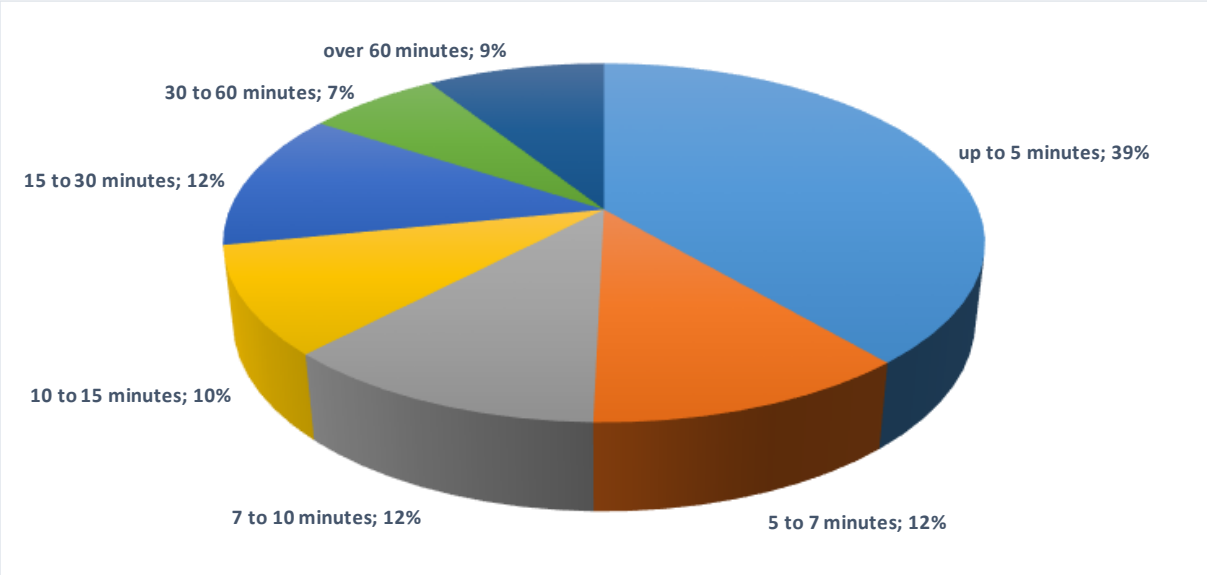


Figure 11. Time of reloading operation structure

After removing from the database the parking times of those over 2 hours (assuming vehicle parking, not unloading), the **average** reloading time is **13 minutes and 30 seconds**. This leads to the conclusion that with even 10 occupations per day during the 9 hours of peak delivery the bays are used for ***25,6% time***. The result in the post-pilot survey was very close to real measurement – respondents indicated 27% as the number of bay occupation. The rate of occupation indicates a little chance of finding a bay occupied and therefore limited need to book it via application. It should be noted that the pre-pilot survey results (D4.6 Set-up Report) indicated twice the operational time (approximately 28 minutes) and thus a 50% chance of finding the bay occupied which means the *reduction of traffic because of pandemia.*

Parking time is a prerequisite for determining the object of reloading. Assuming that operations that take longer than 15 minutes are reloadings of pallet units carried out by trucks, we obtain approximately 28% of the operations. The remaining operations are assumed to be performed by cars or vans. A comparison of this approximation with the results of the pre-pilot survey are showed in Figure 12 - the column of the left represents the results of the pre-pilot survey (described in D4.6 Set-up report), the one in the right the approximation based on the field operational tests with systems data and post-pilot surveys.

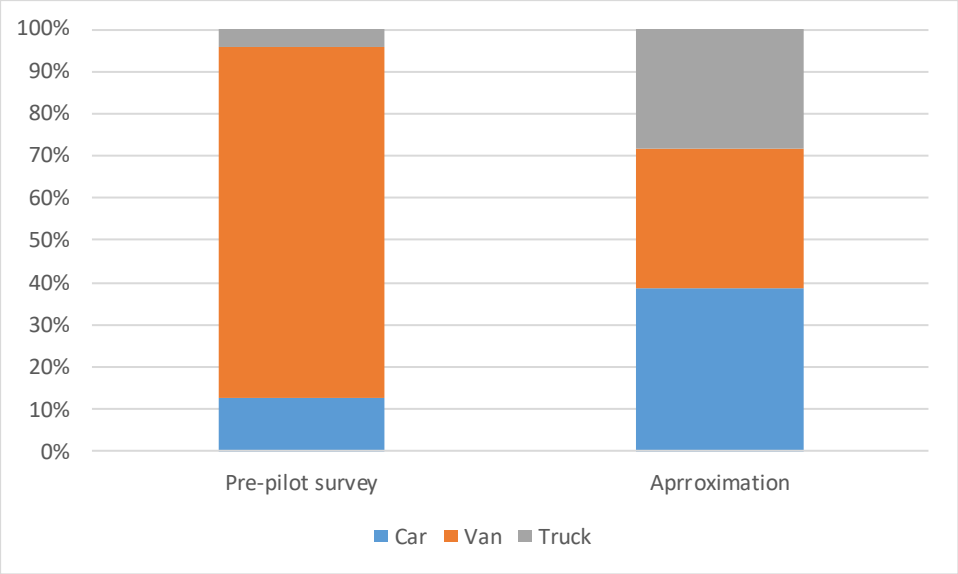


Figure 12. Delivery vehicle comparison

As it is more difficult for truck drivers to stop outside the bays, unlike drivers of smaller vehicles, this significantly distorts the results of the survey. It should be recognized that long-lasting reloading are mostly carried out in designated areas. It is impossible to indicate how many operations of reloading are carried out besides bays. The very short handling times create a temptation to park illegally directly in front of the delivery point and further reduce the operation time.

Respondents of survey pointed out that city services should react faster to parking irregularities. On the other hand. with such short-time parking it is very difficult. The solution could be the barriers limiting entering of the square - e.g. movable posts like. This could be a guideline for city policy.

According to the respondents in the post-pilot survey, approximately **67% of reloadings are carried out outside the bays**. This means that with an average bay occupation of 9 reloadings daily per bay, **18** are simultaneously carried out in other **unauthorised locations**. The figures analysed so far indicate the total reloading operations carried out in the centre of Kalisz. Admittedly, the distribution of the existing bays is not homogenous over the entire area, but assuming that 8 of them (including 2 new bays) cover approx. 50% of the centre area, the total number of reloading operations per day in the city centre can be estimated at around 400.

As stated before, the situation might be different than normal because of the pandemic inluence. Even during the short period, the decrease of deliveries can be indicated. The number of occupations in one of the bays during the period of the pilot (Figure 13) indicates the decreasing trend in deliveries to the city centre. However, it should be noted that the scale of the trend was affected by the Christmas break in deliveries (circled).

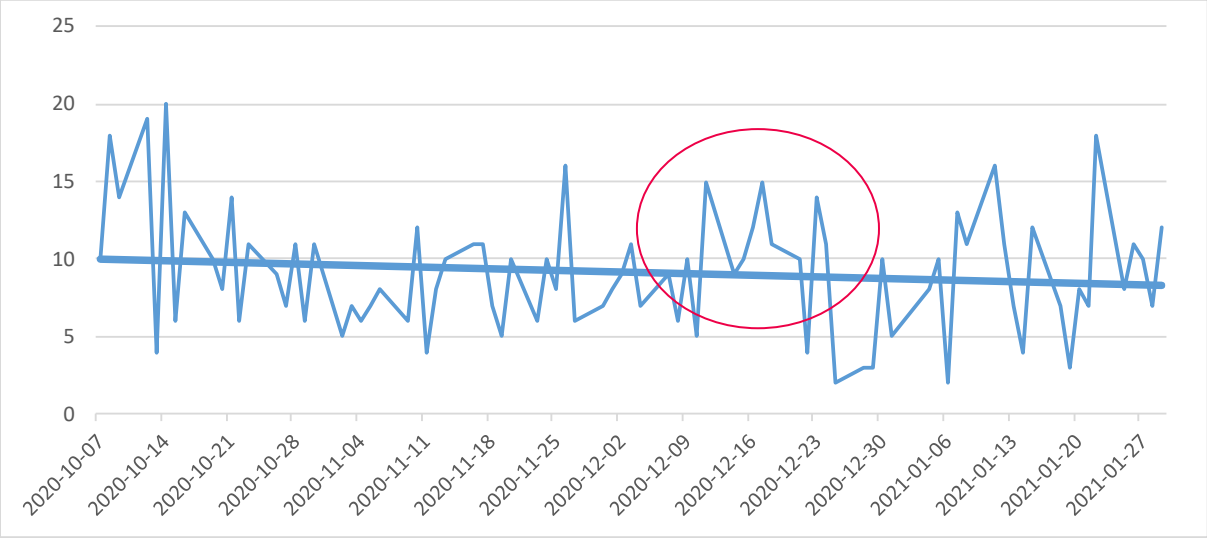


Figure 13. Trend in the daily number of the reloading operation on Św. Stanisława Street bay (weekdays only)

The graph does not show a clear effect of the dissemination campaign (conducted end of October 2020) on the launch of the system comparing to the situation before and after the project launch. This is probably caused by the earlier availability of bays with relevant information about the project on road signs nearby, which was placed a few weeks before starting the project.

The post-pilot study provided answers to questions that the analyses achieved from the system data could not indicate. The responders estimate, that bays are occupied in 27% of their availability time (in case of drivers' opinion the value is even higher). Assuming that this value relates to real delivery times it means that once in every four parking attempts a space is occupied. In terms of reducing traffic, pollution and noise and improving safety, respondents were unanimous in rating the impact of implementing the pilot at just over 20%. Slightly higher, at over 30%, were the results, in responders' opinion, in manoeuvring reduction time and the need to return to the loading site, which brings the very good result.

The last statement, which seems very important here, indicates that only 33% of reloading operations are carried out in the designated place, which in turn means that two thirds of reloadings are carried out illegally. It should be assumed that these are small deliveries requiring a short stopping time, which have not been recorded in any way by the system of sensors. Only 33% of reloading operations were recorded by pilot installation.

Detailed results, divided into responders' groups, are presented in Figure 14.

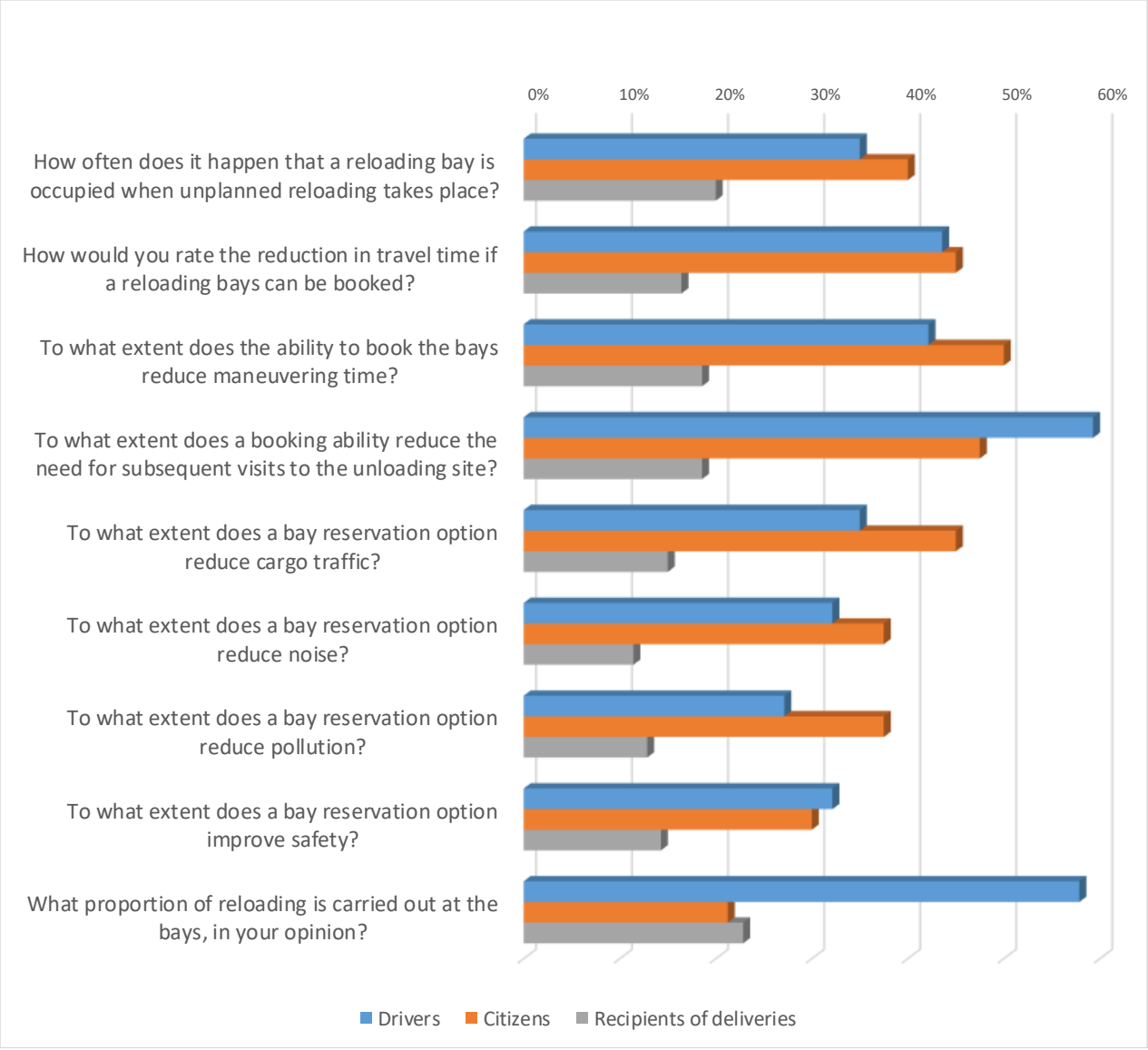


Figure 14. The post-pilot survey results

Key performance indicators

The key performance indicators were divided in set-up report into two areas: in scope of sustainability assessment of the pilots' impacts and City specific policies for harnessing the impact of new mobility systems. The first area of indicators was calculated based on data

achieved from the sensors system and the second area of indicators were the results of the post-pilot survey (see Table 4).

The assessment of the solution is positive and gives recommendation to implement similar solutions in other locations. The reduction of travel time (distance) and manoeuvring time reaches nearly 30%, reduction of subsequent visit even 34%. The reduction of cargo traffic as a result of the booking possibility has been rated at 25% (I402), reduction of pollution and noise at 21%, similarly to safety improvement (22%). And as stated before 33% of all reloading operations are carried out, on reloading bays.

Table 4. Performance indicators in scope of sustainability assessment of the pilots' impacts

Indicator	Value	Comments
Financial Sustainability		
Financial sustainability	not measured	drivers avoid fees
Operational feasibility		
Functional suitability	90%	estimated, based on interviews – share of answers without problems with application.
Usability	27%	share of reloads conducted on bays
Operational feasibility		
Effectiveness	33%	based on post-pilot survey: *"To what extent does the ability to book reduce the need for another arrival at the unloading site?"*
Efficiency (I401)	66%	availability of the service due to sensors damage and road construction
Satisfaction	33%	based on post-pilot survey: "*What proportion of reloading is carried out at the bays, in your opinion?*"
Reduction of truck-kilometres	25%	based on post-pilot survey: "*To what extent does a booking ability reduce the need for subsequent visits to the unloading site?"*
Performance		
New bays utilisation	68%	compared the existing one (100%), the new bay (68%) utilisation, new bay 32% less than existing bay
Installing application ratio (I411)	28	number of user / installations
Number of parkings per bay	10,3	weekdays only, on average per bay
Utilisation of the bays	25,6%	assumption: 9 hours daily operation time
Reloading time per bay	2:18:21	daily, on average
Environmental & social KPIs		

Indicator	Value	Comments
Noise reduction	21%	based on post-pilot survey: "*How far does a bays booking ability reduce noise?"*
Accidents reduction	22%	based on post-pilot survey: "*To what extent does a bay reservation option improve safety?"*
Traffic congestion reduction (I402)	25%	based on post-pilot survey: "*To what extent does a bay reservation option reduce cargo traffic?"*
Growth of safety	22%	based on post-pilot survey: *"How far does a bays booking ability improve safety?"*
Pollution	21%	Based on post-pilot survey: "*How far does a bays booking ability reduce pollution?"*

The second part of KPI calculation mostly utilizes the knowledge of the project team – see Table 5.

Table 5. Performance indicators in scope of City specific policies for harnessing the impact of new mobility systems

Indicator	Value	Comments
Policy implementation feasibility (legal)		
Legal framework compatibility	2	Location of the base station on historical building, required technical projects of the new bays
Policy implementation feasibility (operational)		
City Investment costs	800 EUR	estimated cost of next sensor, its placing and integration, base station and system exists
City Operational cost	unknown	depending on the sensors selected and their durability
City Revenues	none	expected after implementation of recommended policies
User acceptance		
Probability of using the service	33%	over 18% hesitant

The operational feasibility of the technical solution, as described above gave **many doubts**, especially in the field of sensors **durability**. One of the sensors was damaged, probably while removing snow, as the moment when its work was interrupted coincided with significant snowfall. The second one has been leaked. The third one stopped working just before data collection (undefined reason). This means that during the four-month test, all 3 sensors failed throughout.

However, for whatever reason, the sensors used did not pass the test under real conditions during the pilot. This means that their use in similar installations in the local climate is

questionable. It should be emphasised that, based on the experience in the project, it cannot be recommended for implementation in similar installations. This result applies to places of similar climate to Poland. For the purposes of further tests, it is advisable to use sensors placed under the road surface (lower possibility of damage) and with the possibility of incidental two-way communication to assess the state and status of the sensor on an ongoing basis. Unfortunately, this is associated with an increased demand for electricity and thus a shorter battery life. Perhaps camera-based solutions, image cognition and AI algorithms are able to determine whether a space is occupied or not. This should be subject to further testing.

The other equipment, mainly the base station, despite working on an LTE connection rather than the assumed cable one, and the software worked perfectly well during the test. The users underlined the necessity of registration as a correct approach (it is already necessary) and the possibility of paying fees via the application as a need. The latter could be implemented in Kalisz based on external applications such as Skycash or Mobilet (local Polish applications for parking tickets). Other way of charging the drivers could be entry or periodical subscription fees. This way the transport operators would be forced to pay for a parking and the valuable drivers' time for buying a parking tickets, on- or offline, would be saved.

3.5.2 Process

The most time-consuming was to obtain the permits and prepare the projects, which was greatly simplified by the participation of the City in the consortium. The location of the base station on one of the highest buildings in the centre of Kalisz, despite the necessity of obtaining the consent of the conservator of monuments, resulted in sufficient coverage in all locations of the bays.

Acceptance of the drivers of the solution is a separate issue. Despite the confirmed provision of information about the system, few of them decided to use the application. This was partly explained by their lack of time (they usually lack it). However, it can be assumed that the reservation in the application leaves a trace, which, in the opinion of drivers, can be used to try to prove parking without paying the fee, which is unfortunately common. On the other hand, the lower utilization of the bays found on the basis of the system data than it resulted from the pre-pilot survey, and the higher percentage of parking in prohibited places, right next to the delivery spot, is a basis to claim that in the opinion of the drivers the reservation is not necessary to perform unloading activities, sometimes in an illegal manner. The threat of sanctions, in their opinion, seems to be too low to make an effort to deliver goods to the centre of Kalisz in full compliance with the rules.

Laboratory, preliminary technical testing and selection of equipment for installation was fraught with some risk - functionally in laboratory conditions does not ensure the correctness of the actual, prototype installation. Hence the push for the best possible base station location. And despite the described difficulties it should be emphasized that the installation worked properly except for technical problems with the sensors and communication between the server and the base station, initially planned to be wired, and finally based on Global System for Mobile communication (GSM).

3.5.3 Policy-related and regulatory barriers

The main identified policy gaps include **low levels** of reloading bays **occupations during night** hours and **parking payments** which required additional, time-consuming efforts from the drivers. The third aspect is the **low probability of being penalised** for stopping nearby the bays without paying and for reloading in places not intended for this.

The most important barrier is the **attitude of the drivers**, that prefer parking close to the delivery location to save time of the operation, even with the probability of penalty. The additional one is **lack of budget** for parking fees in operators' companies. The level of the total charge is quite low (for the finances of an operator), but there are no practices to plan and budget for this type of fee. Due to the low level of fees, this barrier is relatively easy to overcome.

3.6 Conclusion

The bays are used on average 9 times a day. There are two reasons for such limited number. First the pandemic with unknown influence on city deliveries. The second is the very short time of reloading operation (close to 40% in less than 5 minutes), enabling drivers to park in non-designated spaces and avoid fees. There is also a logical explanation for this - parking in a prohibited space usually shortens the manual transport route to the delivery location and further reduces the time of the entire operation.

The two created bays have a level of occupancy over 50% of the previously existing one (actually 62% on Narutowicza Street and 75% on Złota street), which proves the validity of their creation and the correctness of the choice of location. This exceeds the assumed in set-up report level of the project indicators.

Most reloading activities take place between 6:00 a.m. and 6:00 p.m. At other times reloading bays may be used for parking. In particular in heavily populated areas. This, would require changes in local policies and disciplining drivers to leave parking spaces in the early hours of the morning. However, it would allow for rational use of available parking spaces in a congested city centre.

The next conclusion from the project is that the demand for bay reservations needs to be reviewed. It is difficult to indicate what level of occupancy justifies the introduction of a reservation and at what level of availability drivers will decide to use the application. In the case of Kalisz, the 25% chance of having to come again did not convince the drivers.

Drivers try to make operation as fast as possible. The parking close to the delivery door reduces the operation time. Hence, the drivers are not motivated to use bays. Leaving aside the level of charges, time is also needed to carry them out. On the other hand, all delivery drivers entering the centre are forced to park for reloading. Therefore, they should, by assumption, pay for parking. It is therefore advisable to adopt subscription or entry fees. This way, drivers' valuable time will not be, in their opinion, wasted on parking fees. And the necessary fees will be paid by the transport operators. The method of charging, whether in the form of a periodic subscription or as a single-entry payment using an app, is a secondary issue.

It will force drivers to bear the cost of parking, even for 5 minutes, and will not affect the timing of reloading operations.

4 T4.4 Formulation and prioritisation of alternative policy responses

4.1 Introduction

The third stage of the SPROUT project is the setup and implementation of the pilots in each of the pilot cities. The aim of Task 4.4 is to develop, based on the outcomes of the pilots and the operational assessment (Task 4.3), a list of alternative policy responses for each of the 5 pilot cities. The alternative policy responses will then be prioritized for each pilot city with the help of Multi-Actor, Multi-Criteria Analysis (MAMCA) (Macharis, De Witte, & Ampe, The multi-actor, multi-criteria analysis methodology (MAMCA) for the evaluation of transport projects: Theory and practice, 2009).This will allow the identification of synergies and conflicts between different stakeholder groups, to show the (lack of) consensus for the proposed policy alternatives.

Because of the COVID-19 pandemic and the various lockdowns in the Fall of 2020, the implementation of the tasks preceding Task 4.4, and most importantly the implementation of the pilots, was delayed. A traditional MAMCA departs from a problem identified, and formulates alternative solutions to a problem. These alternative solutions are then evaluated by different stakeholder groups to show which alternative has the highest consensus among stakeholders. So as the first step of a MAMCA is a problem identification phase, it was difficult for the pilot cities to come to a problem identification with regards to the pilot due to it not yet being (fully) implemented. This made it difficult to distinguish several potential alternative policy responses. If more than one policy response was proposed, they were not mutually exclusive. This meant that the implementation of one policy alternative did not impede the implementation of the other alternative. For a MAMCA, if there is to be a consensus on one of the alternatives, the proposed alternatives need to be mutually exclusive. If they are not, then the solution would simply be to implement all alternatives. For these reasons, it was decided to implement a modified MAMCA, a Stakeholder-Based Impact Scoring (SIS) instead (te Boveldt, 2019).The methodology and its application will be explained in more details in the section below (Chapter 4.2).

4.2 Methodology

4.2.1 Multi-Actor Multi-Criteria analysis

Multi-Actor, Multi-Criteria Analysis is an evaluation method that includes both quantitative and qualitative criteria with their relative importance, as defined by multiple stakeholders (Macharis et al., 2009). It is used for the participatory evaluation of projects where multiple stakeholders and multiple objectives are to be included. The aim of MAMCA is to facilitate the decision-making process by showing the conflicts and the synergies of different stakeholders.

The method starts with the identification of stakeholders and their objectives, to then come to a prioritization of different alternatives, based on the weights attributed by stakeholders to their criteria. However, Macharis et al. (2012) highlight the importance of not focusing only on the final aggregated, prioritized results of a MAMCA, but on the reasons for why an alternative score negatively or positively. It allows stakeholders to reflect on their objects, and shows the

trade-offs all stakeholders have to make. The results of the MAMCA can then start a discussion among stakeholders to find a consensus.

4.2.2 Stakeholder-Based Impact Scoring

Stakeholder-Based Impact Scoring (SIS) is a modified MAMCA that provides a weighted impact evaluation of policy options (te Boveldt, 2019). This impact evaluation considers the objectives of stakeholders that impact, or are impacted by, the problem described, thereby quantifying the benefits and burdens of project alternatives. It was developed for problems that cannot be addressed through the ranking algorithms of other MCA methods. The SIS method contains two fundamental aspects (te Boveldt, 2019):

- *Non-compensability*: the principle of non-compensability entails that positive and negative impacts are accounted for separately, and do not cancel each other out.
- *Non-relativity*: if there are multiple alternatives, these alternatives are not compared to each other, but to a baseline scenario.

SIS steps

The application of SIS involves seven different steps (te Boveldt, 2019):

1. Formulation of the problem and identification of alternative solutions. In order to perform a SIS, there should minimally be one baseline, and one alternative to the baseline.
2. Stakeholder identification. The stakeholders that impact, or are impacted by the project need to be identified.
3. Formulation of stakeholder criteria. These criteria represent the objectives of the stakeholder with regards to the problem and the identified alternative solutions.
4. The effects of the alternative in terms of each criterion when compared to the baseline scenario are assessed through a performance score ranging from +1 (very positive) to -1 (very negative).
5. Attribution of weights to their criteria by the stakeholders, to evaluate the relative importance of each of the criteria.
6. Impact score calculation of each alternative for each criterion, for each stakeholder. This is done by multiplying the weight of a criterion, as attributed in step 5, with the impact, as assessed in step 4. This impact score will be either positive or negative, and will fall between +1 and -1.
7. Calculation of the aggregate positive impacts and of the aggregate negative impacts.

4.3 Application of SIS within SPROUT

The application of SIS within the SPROUT project followed the steps described in the previous section. It was applied to one use case per pilot city. The following section describes steps 1-5 more in detail. These steps make up the preliminary work of SIS, i.e. the gathering of all necessary input for the analysis. Section 5 (Results) describes steps 6 and 7, i.e. the results of the analysis, for each pilot city.

4.3.1 Formulation of problem and identification of alternatives

The first step in the SIS is the identification of the problem and the alternative solutions. To do this, a template was sent out to all pilot cities containing questions with regards to issues they had identified with their pilots. This was filled out and sent back to VUB. For Kalisz, extra clarifications was not needed asked, as the identified problem and policy alternatives were specific enough.

The section below gives an overview of the identified problems and proposed policy solutions for the city of Kalisz.

Table 6. T4.3: Kalisz identified problems and proposed solutions

Problems and possible solutions	Description
Problem encountered	Use of loading bays only for a limited time during delivery hours. For the remaining time (e.g. night hours) the place is not used and at the same time unavailable to residents.
Possible Solutions	Modification of rules, allowing to park private cars during indicated hours and / or days (for example weekends). In cooperation with drivers / forwarders, exclude parts of the weekdays from delivery (indicated bays), for example 3 days for deliveries, 2 days (plus weekends) for parking.

4.3.2 Stakeholder identification

In order to come to a weighted evaluation that reflects the preferences of stakeholders, it was necessary to identify the stakeholders to involve in the SIS. The stakeholders to involve are the ones that are impacted, or can impact, the pilot project of the city. To do this, the pilot cities were asked to contact stakeholders that had been previously involved in the scenario building workshops of WP3. The participating stakeholders in WP3, in turn, were the result of the stakeholder identification done in Task 2.3, 'Urban Mobility Transition Drivers'. After asking the cities to contact some more stakeholders than the ones present for the WP3 workshop, the full overview of participating stakeholders per city is described in the following paragraph:

- Kalisz Municipality;
- Infrastructure (Road and street lighting, Municipal Roads Administration);
- Business incubator;
- School;
- Entrepreneurs and companies (Photovoltaic company, Design office);
- Logistics Service Providers;

- Local shops and restaurants.

4.3.3 Formulation of stakeholder criteria

The third step in SIS is the identification of the criteria for each stakeholder group. The key question for the formulation of criteria is the following: *what distinguishes a good project alternative from a bad one?* Stakeholders therefore reflect on what their objectives are with the implementation of a project. These criteria can be both positive and negative, and examples include traffic safety, cost, or accessibility. Within SPROUT, the alternatives that stakeholders were asked to reflect upon were the pilot situation without policy changes, as well as the pilot situation with the proposed policy alternatives.

In order to collect stakeholder criteria, an email template was set up for all pilot cities. This email, that can be found in Annex 2.2, contains a short description of the pilot without policy changes, and a short description of the pilot including the policy alternatives. The stakeholders were asked to come up with two to six criteria that would make the implementation of the pilot situation with policy changes successful, in their eyes. This step required a lot of exchanges with the city, as it was not always clear from the beginning what was understood by 'criteria'. After two or three rounds however, a consolidated list of criteria for each stakeholder group was obtained.

An overview of the criteria per stakeholder group for Kalisz can be found below.

- Kalisz City Hall;
  - Road safety
  - Ease of use
  - Improvement in air quality
  - Traffic reduction
  - Adequacy of used technologies for research purposes
- Infrastructure (Road and street lighting, Municipal Roads Administration);
  - Accessibility to users
  - Allocation optimization of available parking spaces
  - Ease of use
- Business incubator;
  - Costs
  - Accessibility
- School;
  - Adaptability to demand
  - Compatibility to city development plans
  - IT integration
- Entrepreneurs and companies (Photovoltaic company, Design office);
  - Ease of parking regulation enforcement
  - Improved accessibility to Logistics Service Providers
- Logistics Service Providers;
  - Ease of use
  - Allocation optimization of parking spaces
  - Road safety

- Local shops and restaurants.
    - Ease of use
    - Adaptability to varying needs

4.3.4 Expert evaluation

After the identification of stakeholder criteria, the next step of the SIS is an evaluation of policy intervention on the impact of the policy interventions on these criteria by experts. In this step, the effects of the pilot with policy implementation are compared to the pilot without policy changes for each of the criteria. The alternative is given a performance score on a 7-point scale, ranging from 'Very negative' to 'Very positive'. The key question to answer in this step is the following: in terms of each criterion, *what are the impacts if the alternative pilot with policy changes were implemented?*

The scientific partners in each of the pilot cities were asked to evaluate the alternative in terms of their stakeholders' criteria. Annex 8.3 contains the email with explanation that was sent out to the scientific partners. If the experts had any additional information or justification for their evaluation, they were asked to add this to the evaluation form as well. Below, the results of each expert evaluation are shown.

Table 7. Pilot experts' evaluation results.

Criteria	Scenario 1: current situation	Scenario 2: pilot compared to current situation	Performance score of the pilot compared to current situation	Justification for the chosen evaluation
Road safety	Smart delivery bays that can be booked through an app, with the use of the delivery bays being limited to delivery hours.	Regulations for the smart bays will be adapted, and private cars will be able to park on them during dedicated hours and/or days (like on weekends).	slightly negative	Some drivers may use the mobile app while driving. The greater number of potential users may make such situations occur proportionally more frequently. Besides, traffic may increase near the unloading bays, which increases the risk of road collisions.
Ease of use			slightly negative	Additional rules increase the risk of incorrect use of the solution by drivers (e.g. blocking parking spaces by private vehicles during the hours designated for delivery vehicles due to ignorance of the rules or mistakes).
Improvement in air quality			positive	Private vehicles will move around the city in a more organized way - a parking point will be identified and reserved before the trip, which will reduce unnecessary "cruising" around the city centre to find a stop.
Traffic reduction			positive	Traffic will increase only in the immediate vicinity of unloading bays, but will be more organized throughout the city centre, which will reduce traffic congestion.
Adequacy of used technologies for research purposes			slightly positive	On the one hand, a change in the rules of use may be associated with a change in the operation of the application - the driver will indicate the type of user in the application (supplier / private person), thanks to which the city will gain access to more analytical / research data. On the other hand, sensors cannot distinguish between vehicle types, so the reliability of the data will depend on the truthfulness of the users.

Criteria	Scenario 1: current situation	Scenario 2: pilot compared to current situation	Performance score of the pilot compared to current situation	Justification for the chosen evaluation
Accessibility to users			very postive	The developed solution will be available to several times larger group of users.
Allocation optimization of parking spaces			slightly positive	During dedicated hours/days the solution will be available to a large group of users who previously did not have permission to use unloading / parking bays - private vehicles will have more parking spaces.
Costs for users			no change	There is no paid parking zone in Kalisz during the dedicated hours for private vehicles (6:00 P.M. – 6:00 A.M and at weekends), so the costs will not change.
Adaptability to demand			very postive	Dedicated hours of use of unloading bays by different user groups are tailored to the demand for parking spaces.
Compatibility to city development plans			slightly positive	The city's strategy assumes the development of infrastructure to reduce noise, traffic and pollution, and the new solution enables the achievement of these goals at a higher level.
IT integration			slightly negative	The booking application will be more complex (new functionalities: distinguishing types of users, the possibility of booking at different times depending on the type of vehicle), which may slightly complicate the potential integration with other IT solutions.
Ease of parking regulation enforcement			negative	More complex rules of use will make it difficult to control users' compliance with the regulations.
Improved accessibility to Logistics Service Providers			negative	Private cars may abuse the solution (park in the hours designated for suppliers), which will limit the availability for LSP's. Occasionally, private vehicles may take parking spaces during the hours reserved for deliveries due to

Criteria	Scenario 1: current situation	Scenario 2: pilot compared to current situation	Performance score of the pilot compared to current situation	Justification for the chosen evaluation
				users not knowing the rules. In the case of deliveries at unusual times (evening deliveries, weekend deliveries), delivery cars will not be able to use the unloading bays (according to the new regulations).
Adaptability to varying needs			very postive	The dedicated hours of use of smart parking spaces will be tailored to the needs of different user groups (not only suppliers).

4.3.5 Criteria weighting by stakeholders

The next step in a SIS evaluation is the attribution of weights by the stakeholders to their criteria. This shows the relative importance that the stakeholders attach to each criterion. To evaluate this, a survey was set up to be distributed to all stakeholders within each of the pilot cities. The survey was set up by VUB, and an example for the city of Kalisz can be found in Annex 8.4. To facilitate the process for the stakeholders, it was decided to translate the surveys in the local language. This was done by each pilot city.

4.3.6 Results

This section provides the result of the SIS analysis for all pilot cities (steps 6 and 7).Figure 15 and Figure 16 show the expected negative and positive impacts of the Kalisz pilot as compared to the current situation using the MAMCA-SIS approach. While the current situation (smart delivery bays that can be booked through an app, with the use of the delivery bays being limited to delivery hours.) is taken as a baseline, the pilot involves the adaptation of regulations for the smart bays, with private cars will be able to park on them during dedicated hours and/or days (like on weekends).

As can be seen in Figure 15, ‘accessibility to users’ is expected to be by far the most important positive impact, followed on distance by ‘adaptability to demand’, ‘adaptability to varying needs’ and ‘allocation optimisation of parking spaces. The considerable negative impacts include ‘ease of use’, which is considered relevant for multiple stakeholders, as well as the ‘accessibility for logistics service providers’.

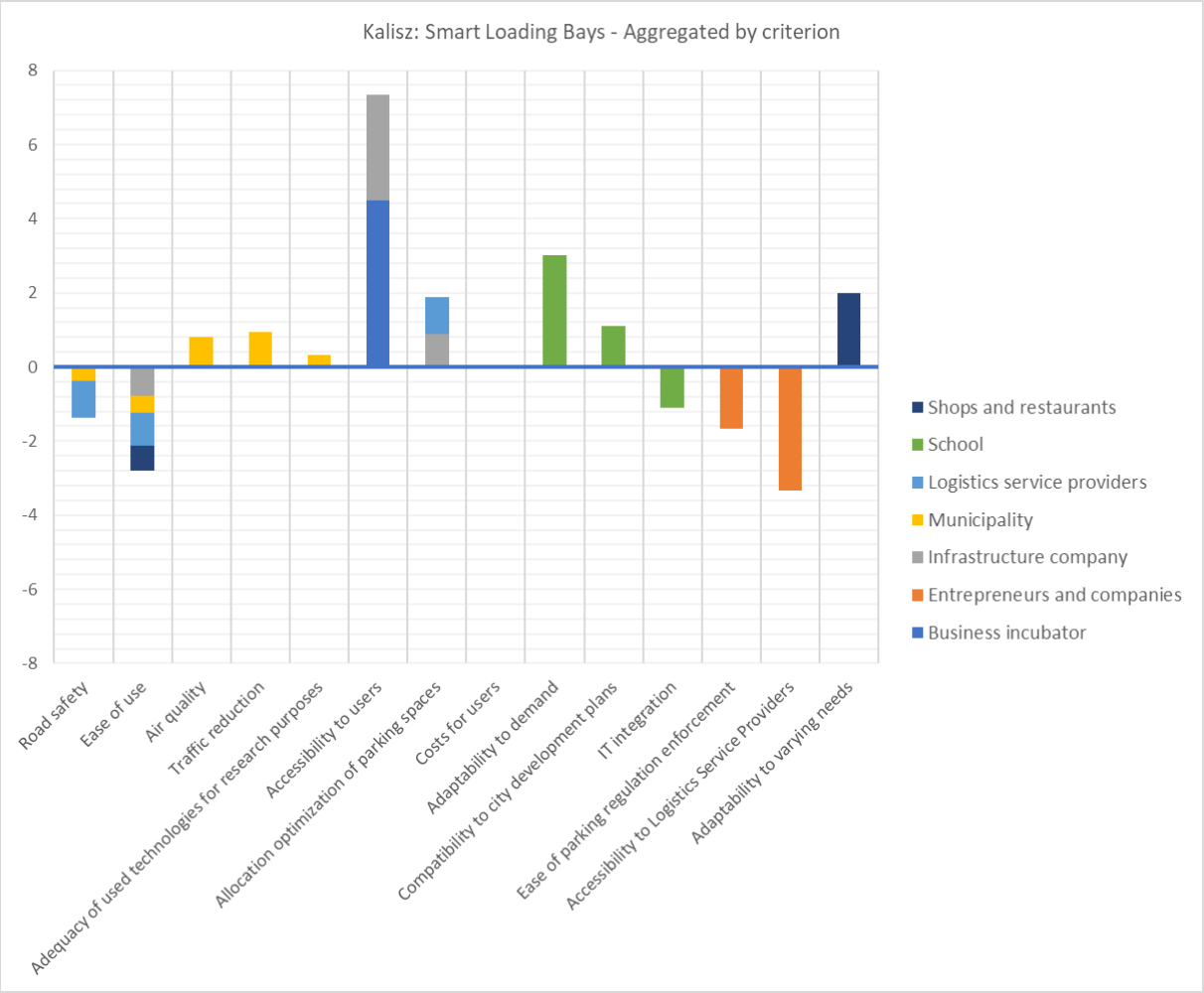


Figure 15- Kalisz: adapted regulation for smart deliveries. Aggregation by criterion.

Figure 16 shows the distribution of positive and negative impacts over the different stakeholders. Here we see that for most stakeholders, impacts are generally considered positive, though for most stakeholder the pilot scores negatively in terms of ease of use. The impacts for logistics service providers and especially entrepreneurs and companies are expected to be mostly negative. For the latter stakeholder, this is due to the negative scores with regard to accessibility for LSPs and ease of parking regulation enforcement.

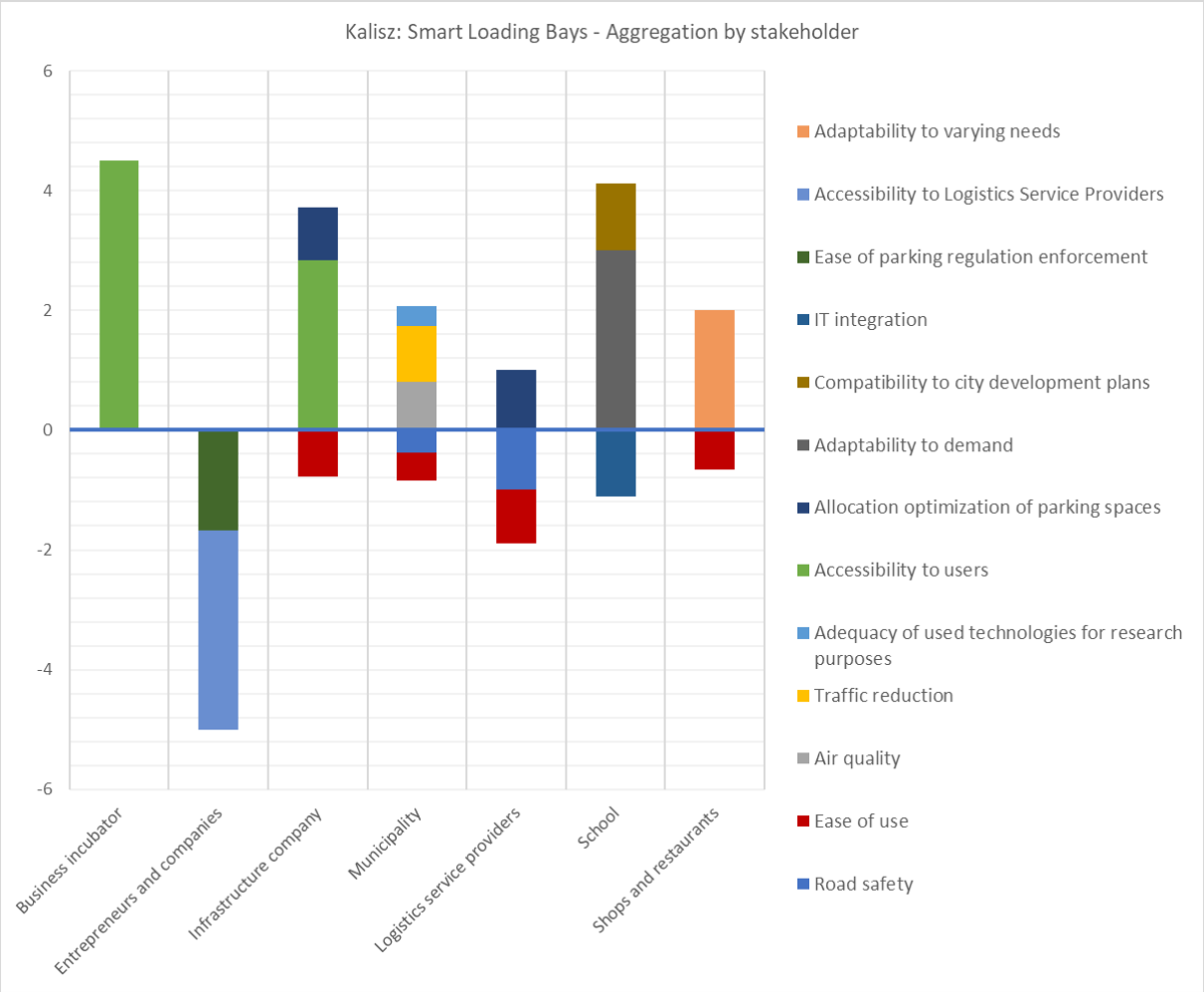


Figure 16. Kalisz: adapted regulation for smart deliveries. Aggregation by stakeholder.

4.4 Conclusion

Compared to the pilot as it is, the adaptation of regulations for the smart bays has mostly positive effects for most stakeholders. Following the analysis, accessibility for users, adaptability to demand and adaptability to varying needs are the most important advantages. The most disadvantaged stakeholders are entrepreneurs and companies, especially because it negatively affects accessibility for logistics service providers. Another point of attention for most stakeholders is the decreased ease of use of the application.

5 T4.5 City-specific policies for harnessing the impact of new mobility solutions

5.1 Introduction

The objective of this task is to compile the information to assess the feasibility and user acceptance of introducing the predefined set of policy responses on a limited scale (city-specific). This task uses some information from formulation and prioritisation of alternative policy responses task, more specifically the set of stakeholders and preferred set of policy responses. About the latter, by the time the T4.3 was implemented the pilots were not able to distinguish several potential alternative policy responses that were mutually exclusive (see section 4), therefore prior this exercise additional policy responses were identified by the methodological partners (VUB, CERTH, ZLC) and shared with the pilots. Then they validated and fine-tuned to better address pilots' characteristics. The result of this task is the combination of champion city-specific policy responses or city-led policy response.

5.2 Methodology

Implementation of effective policy responses that will harness the benefits of the emerging mobility solutions represents a challenging process which can be viewed as a knowledge quest and creation process within an urban stakeholder's network requiring the reduction of uncertainty. Uncertainty is particularly high for those measures that include new science, technology, markets, regulatory frameworks. The types of uncertainties can be categorized as being concerned with technological feasibility, organizational capability and social acceptability.

In order to minimize the uncertainty in implementation of a policy measure and at the same time to maximize its effectiveness, the Task 4.5 will address three main research questions per each pilot:

1. How to assess the policies implementation feasibility?
2. How to assess the policies' user acceptance?
3. How to determine threshold user acceptance and feasibility values for selecting policy responses?

5.2.1 Implementation feasibility

About the first question, the policy implementation feasibility will be addressed by the following steps:

1. Selection the relevant feasibility criteria;
2. Ranking the relevant feasibility criteria by the stakeholders and determining the most critical criteria;
3. Detailed analysis of the most critical feasibility criteria in order to identify potential infeasibilities;
4. Determining a set of actions to avoid the risk of infeasibility during the implementation of a policy measure.

The set of feasibility criteria will include the following dimensions:

1. Technical feasibility;
2. Financial feasibility;
3. Political feasibility;
4. Administrative feasibility.

Detailed explanation of the feasibility criteria included within each of these dimensions are explained below.

1. ***Technical feasibility*** dimension includes following feasibility criteria:
   - Effectiveness: the extent to which the alternative policy measure will reach the goals set in the project statement;
   - Feasibility of implementation: Under this category will be assessed whether technology exists or is readily available to implement an alternative policy measure.

2. ***Financial dimension*** includes impact on the local/regional economy, on expected revenues of public sector or on expenses of local/regional government. Within the financial dimension costs and benefits will be considered. Costs represent the most common financial criteria. The following categories of costs will be considered:
   - Direct costs: the costs directly related to the policy alternative;
   - Indirect costs: additional nonfinancial impacts (noise, congestions, accidents, etc.);
   - Fixed costs: initial investments;
   - Operations and maintenance costs;
   - Opportunity costs.

Benefits can be measured in the same ways as costs. The following categories of benefits will be included:

- Direct benefits: financial effects which are directly attributable to the alternative policy measure;
- Indirect benefits: non-financial effects which are indirectly attributable to the alternative policy measure.

3. ***Political feasibility*** includes two feasibility criteria:
   - Acceptability: Whether or to what extent the alternative policy measure will be acceptable to relevant stakeholders (decision makers etc.).
   - Responsiveness: whether the proposed alternative will meet the real/perceived needs of the target groups.

4. Since alternative policy measures will be implemented by public authorities, it is necessary to assess ***administrative operability or administrative ease of implementation***. Therefore, the following criteria under the administrative feasibility will be considered:
   - Authority: does the public body have the authority to implement the proposed policy?
   - Commitment: to what extent the policy measure has the commitment of different levels of decision making?

- Capacity: does the public authority have the resources to implement the proposed policy measure (skills, financial assets, training, expertise)?

The questionnaire will be used to assess the critical feasibility criteria for each of the set of prioritized policy responses. Participants will rate the policy measures against the different feasibility criteria based on a 5-tier scale (from 'very low' to 'very high'). Those measures with a low feasibility rating (less than 2.5 on a 1-5 scale) against the specific feasibility criteria will be the subject of additional analysis in order to reveal eventual risks of implementation as well as mitigation strategies.

5.2.2 User acceptance

User acceptance includes different indications based on attitudes, believes and norms of individuals that are directly or indirectly affected by a proposed policy measure. More precisely, the user acceptance (social feasibility) relates to the question how will potential users act and react if a certain policy response is implemented. Following main indicators of user acceptance will be used for analysis (this list may be extended depending on the specific policy measure):

1. Personal and social aims;
2. Problem perception;
3. Information and knowledge about;
4. Perceived efficiency;
5. Satisfaction;
6. Usefulness;
7. Affordability.

Detailed explanation of the user acceptance criteria is given below.

1. ***Personal and social aims***. In general, a higher valuation of common social or personal aims will be positively related to acceptability. Users of the service who perceive a proposed policy measure as compliant to their own preferences will express a higher acceptability and acceptance rate.

2. ***Problem perception***. The extent to which a problem corresponding to a specific policy measure is a necessary indication in defining of user acceptance. In general, the high problem awareness will lead to an increased willingness to accept proposed policy measures for the perceived problems. More precisely, in order to assess the user acceptance from the perspective of "problem perception", the respondents will be asked to rank the importance of different factors (perceived as a consequence of non-applying a specific policy measure). It can be assumed that the higher a specific factor is ranked, the more users will perceive that factor as a problem in society and therefore the higher weight will be given to a corresponding policy measure.

3. ***Information and knowledge about***. The level of acceptance can depend on how well informed the potential users are about a specific urban mobility problem (corresponding to a specific policy measure) and about the new policy measure that can be introduced to reduce/eliminate the consequences of the problem. The better the people are informed the

higher acceptance will be. During the questionnaire design, from the perspective of this dimension, the distinction will be made between whether a person feels well or poorly informed or whether he/she is actually well or badly informed. In other words, the difference between objective knowledge and the subjective assessment of the own knowledge must be made.

4. ***The perceived efficiency*** indicates the possible benefits potential users expect from a concrete policy measure as compared to other measures. More precisely, respondents will need to evaluate how they perceive different policy measures and how they evaluate a specific policy measure as compared to other alternative measures. The recognition of corresponding problem and the information potential users have will influence the rate of efficiency. If the users note a specific policy measure as more efficient a higher support to that measure can be possible.

5. ***Satisfaction*** will result in a degree how the policy measure solves the users' needs. Satisfaction will be given by evaluation the policy measure as pleasant/unpleasant, irritating/likeable, undesirable/desirable.

6. ***Usefulness*** is related how the policy measure will support the users' objectives and their transport service use behavior. A potential user can find a specific policy measure effective but not for his own travelling needs. Usefulness is stated as the degree to which a person believes that implementing a specific policy measure will enhance his/her performance.

7. ***Affordability*** is related to socio-economic status of users. It may be assumed that the socio-economic status will affect the user acceptance of a specific policy measure. In cases of some policy measures it can be expected that low income groups should be more opposed to its acceptance. The willingness to pay will depend on income, and it can be assumed that higher willingness will imply a higher acceptance of some policy measures.

User acceptance of policy measures will be estimated based on the responses of experts which will rate each policy measure against each indicator of user acceptance by using the a 5-tier scale (from 'very low' to 'very high'). Those measures that have low user acceptance rate (less than 2.5 on a 1-5 scale) against the specific indicator will be the subject of additional analysis. Additional analysis will results in a strategy for improving the user acceptance of a specific policy measure against a "critical" user acceptance indicator.

5.3 Application to Kalisz pilot

According to the methodology explained in chapter 5.2, the set of alternative policy measures was defined and the survey was designed (added as the Annex 3) to collect the opinions related to the most critical aspects of policy implementation feasibility.

5.3.1 Set of alternative policy responses and stakeholders involved and role

The relevant stakeholders participating in this use case are listed below.

- Kalisz Municipality;

- Infrastructure (Road and street lighting, Municipal Roads Administration);
- Business incubator;
- School;
- Entrepreneurs and companies (Photovoltaic company, Design office);
- Logistics Service Providers;

Table 8. Alternative policy measures (PM): stakeholders involved and role.

Alternative policy response	Stakeholders involved and role
PM1: Adapted regulations for smart bays, with private cars able to park on them during dedicated hours and/or days (like at weekends)	Kalisz Municipality: organizer, funding Infrastructure: organizer Business incubator: advisor School: beneficiary Entrepreneurs and companies: beneficiary Logistics Service Providers: beneficiary
PM2: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.)	Kalisz Municipality: organizer Business incubator: advisor School: beneficiary Entrepreneurs and companies: funding, supplier
PM3: Provision of inner-city micro-consolidation centres	Kalisz Municipality: advisor Infrastructure: advisor, organizer Business incubator: advisor School: beneficiary Entrepreneurs and companies: beneficiary Logistics Service Providers: beneficiary, funding
PM4: Weight and/or size restrictions for delivery vehicles	Kalisz Municipality: advisor Infrastructure: organizer Business incubator: advisor School: beneficiary Entrepreneurs and companies: beneficiary Logistics Service Providers: restricted

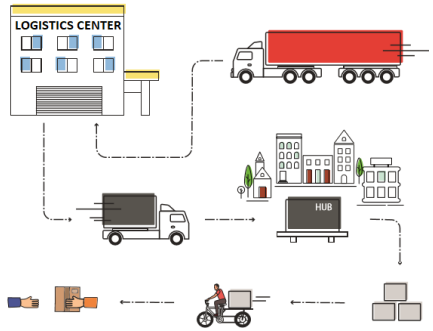
5.3.2 Set of alternative policy responses and interrelationships

Table 9 shows the most preferred policy measures included in the feasibility assessment and the interrelationship with the mobility solution.

Table 9. Use case 1: T4.5 Alternative policy measures (PM) and interrelationships.

	PM1: Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends)	PM2: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.)	PM3: Provision of inner-city micro-consolidation centres	PM4: Weight and/or size restrictions for delivery vehicles
PM1: Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends)	x	One of the environmental / sustainability criteria was: utilization of the reloading bays, reducing availability for private cars parking	Micro consolidation centres could take shape of mobile transhipment consolidation hubs[2] which can be placed and organized on reloading bays areas, reducing space for private cars parking. Mobile transhipment hubs support e-commerce “last mile” distribution through the	More smaller deliveries can influence reloading bays utilization, reducing availability for parking of private cars

[2] The concept of mobile transhipment hubs - green last mile using cargo bikes for packaging distribution, mainly in urban areas.



	PM1: Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends)	PM2: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.)	PM3: Provision of inner-city micro-consolidation centres	PM4: Weight and/or size restrictions for delivery vehicles
PM2: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.)	Reduction of demand for reloading bays caused by increased bike deliveries, can lead to higher bays availability for private cars	x	use of cargo bikes reducing the number of couriers in the city center. One of the environmental criteria was: involvement of micro-consolidation centres assuming higher utilization of e-vehicles and cargo bikes for “last mile”	Weight and/or size of deliveries can be one of the environmental criteria boosting the use of cargo bikes
PM3: Provision of inner-city micro-consolidation centres	Micro-consolidation centres can reduce demand for reloading bays because of reduced number of cargo vehicles entering the centres, freeing up further areas for the use by private drivers	Micro consolidation centres support consolidated cargo deliveries contributing to environmental criteria	x	More smaller deliveries can increase demand for micro-consolidation centres
PM4: Weight and/or size restrictions for delivery vehicles	The parameters of the reloading bays should be adjusted both to delivery vehicle parameters and private cars	Weight and/or size of deliveries can be one of the environmental criteria	Weight and/or size restrictions are in favour of the development of micro-consolidation centres which can cope with reduced parameters of supplies easier	x

5.3.3 Implementation feasibility

The survey' questions (six in total) aim to evaluate the selected alternative measures against the most critical dimensions of feasibility – technical, financial, political and administrative feasibility as it has already explained in the Methodology section. The survey was circulated via Qualtrics platform among the stakeholders relevant for implementation of Kalisz pilot.

In total 15 respondents participated in the Feasibility Survey. The structure of the respondents as well as their share is illustrated on Figure 17.

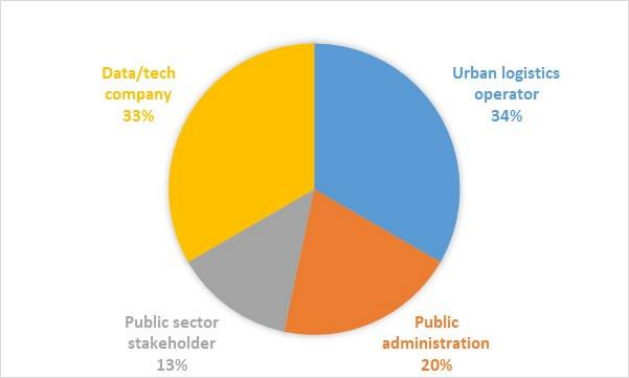


Figure 17. Feasibility study - Kalisz Pilot: The structure and share of respondents

The responses were analysed and used to identify the relevant questions related to potential PMs infeasibility (identification, analysis, how mitigating the risk). Then, these questions were the object of discussion in the 2nd round of feasibility assessment.

The workshop was conducted at the turn of August and September 2021 in two rounds to adapt to the current availability of participants. The workshops were conducted remotely, using videoconference software. Among the participants there were representatives of:

- business (a representative of a local company and a store located in the pilot area, a representative from the Southern Wielkopolska Food Cluster),
- public administration (representatives of various departments of the Kalisz City Hall, a representative from the public education sector),
- IT (representatives of the project team responsible for the development and implementation of a mobile application and intelligent unloading bays in Kalisz),
- logistics (logistic operator).

In total, 14 participants were interviewed.

Column three in Table 10 contains the relevant questions for PM implementation, risk identification, analysis and mitigation in Kalisz Pilot. Column four includes a summary of the responses collected during the workshop. Annex 3 includes complete responses.

From the process followed, we observe the most controversial policy measure for the stakeholders (particularly for logistics operators) is PM2. The main reason is the high investments to shift the fleet and the need of adapting the current logistic network to the new vehicles. Although it is difficult to quantify to what extent the benefits will compensate for the costs of a large investment, if all goods in the city by environmentally-friendly vehicles, the

benefits would be much greater, and it might be worthwhile. The increased costs may require raising the price of the service. To avoid passing the costs to the citizens, the city might assume the difference. The fact that this measure will be a requirement for subsequent contracts might appeal to more transport suppliers. Moreover, dissemination on the public administration web may increase the likelihood of being hired by other contractors, increasing the attraction of the operators to renew the fleet. Finally, for the administrative side, the only concern is the procurement process.

About PM1, the measure further analyzed in T4.4, the financial feasibility and operations and maintenance costs are the only problematic criteria for the successful implementation. The pilot allowed identifying the sensors maintenance, monitoring and reporting needs. Weather conditions required sparse parts to replace the damaged ones and continuous supervising of the states of the sensors. Automatic data collection along with advanced visualization and reporting techniques may decrease these operational costs.

According to the replies collected during the workshop, the participants consider that the lack of ICT warehouse infrastructure in warehouses and knowledge are the technical barriers for implementing PM3. They suggest outsourcing the activity and learning by implementing a pilot.

Finally, PM4, similarly to PM2, will require operators to increase costs. The participants think the experience of Western cities has shown that introducing such zones in the City Center with a restriction for large delivery vehicles allowed the centre to develop towards a more social environment. They suggest introducing the measure gradually and smoothly for ensuring successful implementation.

Table 10. T4.5.- Implementation feasibility - Second stage: Responses to misalignments.

Policy measure	Dimension Criteria	Questions for PM implementation risk identification, analysis and mitigation	Workshop responses
PM1	Financial feasibility/operations and maintenance costs	What are the real operations and maintenance costs	From the experience Kalisz identified they need to replace the ones damaged; monitor the state of the sensors and their supervision of compliance (if a car made the reservation and paid). Some recommendations are to contract a data analyst for analysing parking space occupancy and creating dashboards and statistics for DM
		Which party will be responsible for operations and maintenance costs	Municipality (city budget).
		How this cost burden can be reduced	IT functionality to automatically collect data from sensors, create reports and dashboards. Buy the sensors most appropriate for the weather conditions and place in the correct locations to avoid damages.
		Will these costs be outbalanced by the benefits	The advantage is that the driver drives directly to a parking space already reserved. Fewer vehicles will be circling the centre in search of a suitable parking space reducing traffic congestion, operational costs and accidents.
PM2	Financial feasibility/direct, indirect and fixed costs	What are the direct, indirect and fixed costs	High costs for transport suppliers to change the fleet; logistic infrastructure not ready; public administration start promoting environmental friendliness and assume higher budgets enabling higher prices (compensate costs).
		Will these costs be outbalanced by the benefits	Promotion of health. To large scale even reduce the climate change. Not possible to measure and monitor the savings in healthcare due to the reduction of air pollutants, noise and emissions.
	Financial feasibility/operations and maintenance costs	What are the real operations and maintenance costs	The most significant cost of this policy measure will be the cost of the fleet replacement and the cost borne by the administration (passing on the cost of fleet replacement to customers).
		Which party will be responsible for operations and maintenance costs	Logistics operators/providers and public administration.

Policy measure	Dimension Criteria	Questions for PM implementation risk identification, analysis and mitigation	Workshop responses
		How this cost burden can be reduced	There is no solution. Probability to reduce costs in a short period of time is hard to find.
		Will these costs be outbalanced by the benefits	Difficult to quantify and conclude if benefits will compensate for the costs of a huge investment. If all goods in the city by environmentally-friendly vehicles, the benefits would be much greater, and it might be worthwhile.
	Political feasibility/Urban logistics operators	What are the reasons for unacceptability?	High costs (not electric vehicles and cargo-bikes). Need to reorganize the distribution operations to accommodate to these new vehicles. It may increase the number of vehicles.
		Measures for overcoming/reducing the acceptability barriers	Promotion on the public administration webs to attract contractors and make clear this example is a trend of the city and not just one-off requirement.
	Administrative feasibility/administrative operability && administrative capability	Does the public authority have the resources to implement the PM2?	Yes. It is connected only with adding appropriate content to announced tenders and concluded contacts.
		Does the public body have the authority to implement the PM2?	Just not confident in applying the criteria and in defending those criteria, for example in court (in the event of a dispute); that the contract does not materialize; risk of higher prices overburdening the budget.
		To what extent the PM2 has the commitment of different DM levels	The entity responsible for introducing the criteria is a given unit, the question is how autonomous individuals are.
PM3	Technical feasibility	What technology?	IT infrastructure: real time visibility for synchronizing resources: advanced data analytics and optimization algorithms; automation for faster handling; cameras to capture the state of a delivery.
		How to overcome the gap?	Storage Infrastructure with the adequate technology. City not warehouse space and know-how, outsource the activity and learn by doing.
PM4	Financial feasibility/operations and maintenance costs	What are the real operations and maintenance costs?	Likely more vehicles will be required (operators' costs may increase).

Policy measure	Dimension Criteria	Questions for PM implementation risk identification, analysis and mitigation	Workshop responses
		Which party will be responsible for operations and maintenance costs?	Operators.
		How this cost burden can be reduced?	Replace the fleet gradually or announce it well in advance or by applying transitional arrangements.
		Will these costs be outbalanced by the benefits?	The experience of Western cities has shown that introducing such zones in the City Centre with a restriction for large delivery vehicles allowed the centre to develop towards more social environment.
	Political feasibility/Urban logistics operators	What are the reasons for unacceptability?	LSP: operators would be forced to modify their vehicle fleet, redesign standard routes, and make changes to the planning of logistics operations to avoid penalties.
		Measures for overcoming/reducing the acceptability barriers	Gradually application (start just during certain hours); risk is the negative impact on traffic/ congestion if large vans on the roads simultaneously. Test the solution during hours may not create communication problems (eg. a pilot).

5.3.4 User acceptance

User acceptance (or social feasibility) analysis aims to provide an insight into the preferences of potential users against the implementation of a specific policy measure.

According to the methodology explained in section 5.2, the user acceptance also takes a comprehensive approach to assessment of user acceptance. In other words, a set of different criteria that reflect the user's acceptance/acceptability are included in the analysis.

Two types of users are dominant for Kalisz Pilot. Thirteen respondents participated in the survey. The structure of the respondents as well as their share is illustrated on Figure 18.

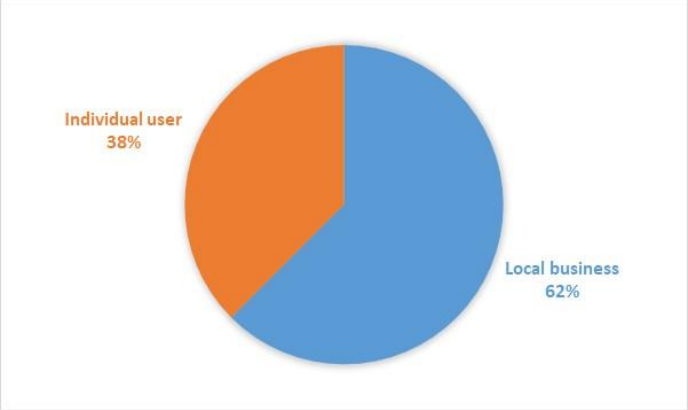


Figure 18. User acceptance study - Kalisz Pilot: The structure and share of respondents

According to the methodology explained section 5.2, the user acceptance analysis also takes a comprehensive approach to the assessment of user acceptance. In other words, a set of different criteria (which in this case belong to one dimension – social feasibility) that reflect the user's acceptance/acceptability included in the analysis.

Column 3 in Table 11 summarizes the findings of the 1st stage of the user acceptance study for the Kalisz pilot. They are relevant questions related to potential unacceptance. Column four summarizes the responses to the questions discussed in the second round of the methodology. Detailed responses are reported in annex 4.

From the results in the table, we observe that PM1 and PM3 are the specific policy measures with misalignments from users' perspectives. The other questions regard the last mile efficiency in general. The former policy fails for the affordability criterion. There were two main conclusions: First, the communication was not clear, and citizens did not understand the measure does not increase the current parking price. Second, the drivers whose deliveries take shorter than 5 minutes avoid fees, so this measure will require them to pay. The mitigation strategy proposed by the Kalisz pilot is to create a subscription system that would provide much convenience and save time. "Lowering price" was examined but dismissed.

Finally, education programmes and dissemination activities using effective channels are the mitigation strategies for improving the user acceptance of PM3 and making the last mile more efficient.".

Table 11. T4.5.- User acceptance - Second stage: Responses to misalignments

Policy measure	Dimension Criteria	Questions for PM implementation risk identification, analysis and mitigation	Response
PM1	Affordability	What are the real costs of PM1 for the user?	In practice, the costs will be the same as in the case of parking in "standard" parking spaces in the city centre. The price for using smart unloading bays was not clearly communicated, so this is probably why participants judged the price to be higher than for standard parking spaces. There may be a fear of obligatory fees by those drivers avoiding them due to they use it for a short time.
		How can these costs be overcome (or gradually introduced)?	Subscription system that would provide much convenience and save users time. Lowering parking prices (a risky solution - people get used to prices quickly, so raising them could be associated with widespread dissatisfaction).
PM3	Personal and social aims	How to eliminate/ reduce the gap between the real effects of PM3 and social and personal aims?	The main problem is the lack of knowledge. The solution for this problem is education, information campaigns, presenting the benefits from the point of view of city residents and businesses.
	Information and knowledge about	How users can be better informed about the effects of PM3 implementation?	Use of communication channels, dissemination activities with the Kalisz Entrepreneurship Incubator and cooperation with organizations associating business (eg. Food cluster, aviation cluster, regional chamber for commerce). Pilot implementation and dissemination activities would increase credibility and confidence.
Efficiency of last mile distributions	Problem perception	How to increase the users' perception about last mile distribution?	Primarily education and raising awareness through advertising campaigns, meetings with the media, raising awareness in schools and universities.

		Information published on local government portals, Facebook and other social media.
Problem awareness	How to increase the users' awareness about last mile distribution?	Information campaigns on various channels. Create a report and publish it on the city's website - presenting how the last mile translates into the cost of goods and what behaviours, choices, technologies allow to increase the efficiency of last mile distribution. This report should be promoted by the City Council.

5.4 City-led policy response

For the stakeholders, PM1, "*Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends)",* may require high maintenance costs. First, to have enough sparse parts, and second, to monitor, analyse and visualise results with automatic reports and dashboards. To reduce replacement parts costs, Kalisz suggests selecting the appropriate sensors based on the weather conditions. Regarding user acceptance, PM1 is not affordable. For the residents, the reason might be that the communication was unclear, so the results are not representative. For the freight drivers with shorter times than 5 minutes that avoid fees, this measure may force them to pay. The solution is to create subscriptions that help them to save time too.

PM2, "*Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.)*" is the most controversial measure for the stakeholders while well received by users. The reasons are that it will require the operators to replace the fleet and reorganize the logistics operations. Both will entail high investments (fixed costs) and operational and maintenance costs and impact. The need to accommodate the logistic network and the lack of operators with the convenient fleet makes the measure politically infeasible. The city may assume the additional costs to avoid increasing the price to the consumers, promote on the public administration webs to attract contractors and make clear this example is a trend of the city and not just a one-off requirement. The benefits of this policy measure are unclear due to the difficulties in quantifying the impact on health.

PM3*, "Provision of inner-city micro-consolidation centres*", arises technical problems related to the lack of knowledge and ICT resources that might be solved by outsourcing a pilot and learning from the experience. Education programmes and dissemination activities are considered essential for understanding the benefits and operation requirements. Indeed, the user acceptance test results confirm that these mitigation strategies may reduce the gap between the real effects of this policy measure and the personal and social aims and increase the knowledge and level of information. Moreover, education programmes and dissemination activities are the foundational requirements for covering last-mile deliveries efficiency problems awareness and perception.

PM4, "Weight and/or size restrictions for delivery vehicles", as occurred with PM2, might be problematic just for the stakeholders. In this case, it will increase the operational costs and generate some political unfeasibility. Both issues can be mitigated if the measure is introduced gradually. Indeed, the experience from Western cities creating more social environments is well-recognized by the stakeholders.

To conclude, PM1 with subscriptions might be the best supporting policy for scaling the mobility solution to other locations within the city boundaries. The procurement process needs to identify those sensors with technical requirements that are more appropriate for Kalisz humidity and cold winter and include some spare parts stock. An automatic monitoring system will facilitate the maintenance activities, assess the usage of the bays and characterize the last-mile operations. PM4 introduced gradually may help to create more social environments while reducing stakeholders' opposition. The city should increase the efforts for building the knowledge gap and the ICT and logistics infrastructure needs that support other policy measures such as PM3. In the short term, a pilot with support from an experienced company

may help overcome these barriers. Finally, PM2 might not be an appropriate policy measure in the short run. The benefits are hard to quantify and the number of infeasibilities found may represent a difficult barrier. Once the city improves last-mile efficiency perception and awareness through education programmes and dissemination, PM2 can be revisited and assessed again.

6 Summary and outlook

One of the weaknesses indicated in Kalisz's Sustainable Urban Mobility Plan is the significant share of heavy freight traffic on the urban road network. Although it was not possible to estimate the magnitude of this trend, it is important since it is being considered by the city and underlined in the main goals of the SUMP. One of the 3 strategic goals in SUMP is road transport safe for the citizens, presented in details in 1.1. Reducing the nuisance of road transport[3].

In response to this challenge, as part of the Sprout project, the consortium also represented by the City of Kalisz has prepared and launched a pilot implementation of an innovative solution - an intelligent loading bay. The solution after some technical lab tests and additional preparation actions was tested on the streets of Kalisz.

The idea of the system is to allow truck drivers to book and use reloading bays with unnecessary driving around the delivery places. The application on the smartphone allows checking availability, book the "slot" and confirm parking. The second confirmation comes from the sensors, located on the area of reloading bays. Both signals from the sensors and confirmation from the drivers are processed and presented in the application.

The functionality of the solution was evaluated using data from the system and a post-pilot survey. The first provided information referred to the usage of sensored bays, including information on peak hours, average parking time, and occupancy rate of each location. The second provided information referred to, stakeholder perception of the solution, their opinion on the solution itself, and the expected effects of its implementation.

The equipped bays are used on average 9 times a day. There are two reasons for such a limited number. First the pandemic with unknown influence on city deliveries. The second is the very short time of reloading operation (close to 40% in less than 5 minutes), encouraging drivers to park in non-designated spaces and avoid fees. There is also a logical explanation for this - parking in a prohibited space usually shortens the manual transport route to the delivery location and reduces the time of the entire operation.

The main conclusions from pilot implementation include:

1. Most reloading activities take place between 6:00 a.m. and 6:00 p.m.
2. It is difficult to indicate what level of occupancy justifies the introduction of a reservation and at what level of availability drivers will decide to use the application - the 25% chance of having to come again because of occupation did not convince the drivers.
3. Drivers try to make the operation as fast as possible, even risking a penalty, so the parking close to the delivery door reduces the operation time. Only if the bays are very close, the drivers are motivated to use them.

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[3] Uzupełnienie Planu Gospodarki Niskoemisyjnej dla Miasta Kalisza o elementy Planu Zrównoważonej Mobilności Miejskiej, version 10.05.2016 r., which is the chapter 2.8 of „Low-Emission Management Plan for the City of Kalisz"

4. Leaving aside the level of charges, time is also needed to carry them out. On the other hand, all trucks or vans drivers entering the centre have to park for reloading. Therefore, they should, by assumption, pay for parking.

It is therefore advisable to:

1. Allow private cars to park on bays during night hours and weekends, under certain conditions.
2. Reduce the “delivery days” to 2-3 per week, with reasonable exceptions.
3. Adopt subscription or entry fees for truck drivers, entering centre of the city.

Compared to the pilot as it is, the adaptation of regulations for the smart bays has mostly positive effects for most stakeholders. Following the analysis, accessibility for users, adaptability to demand, and adaptability to varying needs are the most important advantages. The most disadvantaged stakeholders are entrepreneurs and companies, especially because it negatively affects accessibility for logistics service providers. Another point of attention for most stakeholders is the decreased ease of use of the application.

The last stage of the work package was city-specific policies for harnessing the impact of new mobility solutions. Selected four policy measures were faced with stakeholders in the form of the workshops. Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and at weekends, may require high maintenance costs. First, having enough spare parts, and second, monitoring, analysing and visualising results with automatic reports and dashboards. To reduce costs of parts replacement, Kalisz suggests selecting the more appropriate sensors adequate for the weather conditions. The next considered policy measure, included environmental criteria in public delivery, which has become the most controversial measure for the stakeholders while well received by users. The reasons for that are that it will require the operators to replace the fleet and reorganize the logistics operations. Both reasons will entail high investments (fixed costs) and operational and maintenance costs and impact. Provision of inner-city micro-consolidation centres arise technical problems related to the lack of knowledge and ICT resources that might be solved by outsourcing its implementation to the logistics companies and learning from their experience. Education programmes and dissemination activities are considered essential for understanding the benefits and operation requirements. Finally, weight and/or size restrictions for delivery vehicles might be problematic for the stakeholders. In this case, it will increase the operational costs and generate some political unfeasibility.

The scale of the project and short test period are not sufficient to confirm its impact the reduction of the nuisance of road transport, mentioned in local SUMP. But the project and its findings are relevant indicators not only for the City of Kalisz but also other cities, confirming that innovative solutions may improve the local environment. In the opinion of the respondents the technical solution has proven its functionality, except from the sensors' resistance to local conditions, and effectiveness.

7 References

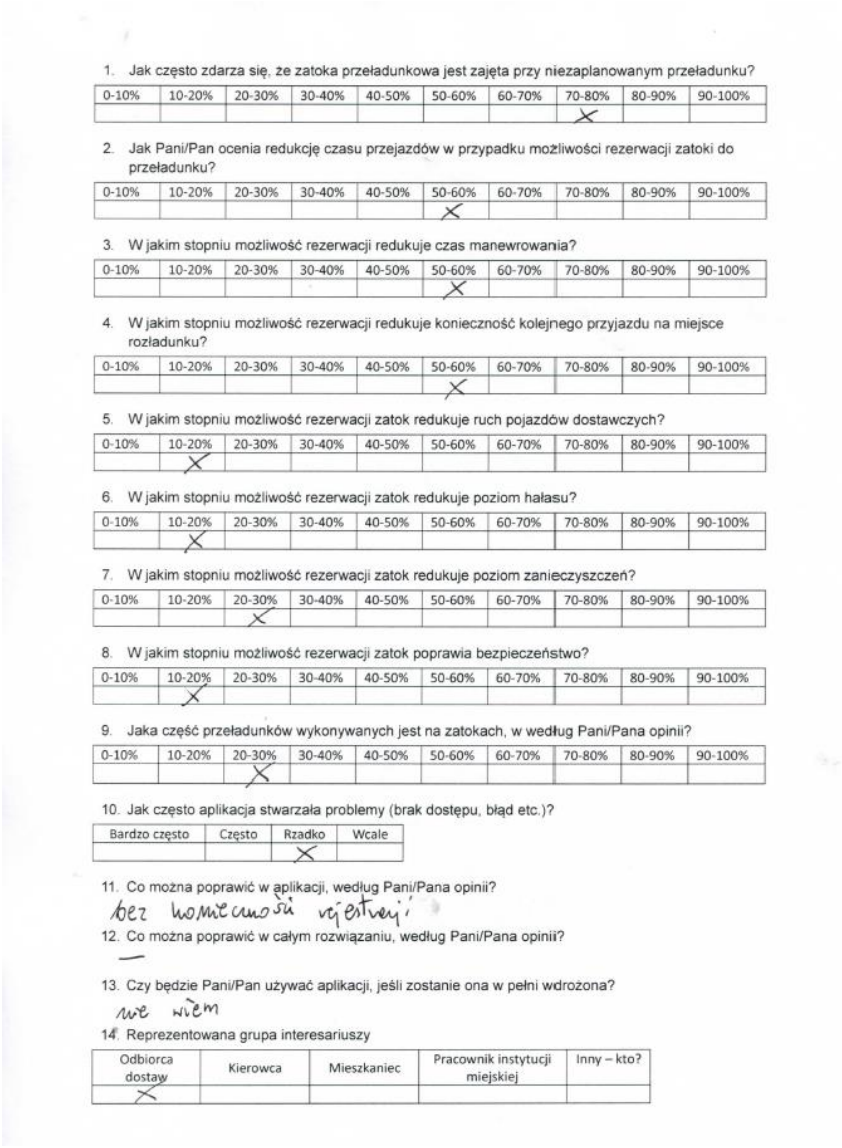
Macharis, C., De Witte, A., & Ampe, J. (2009). The multi-actor, multi-criteria analysis methodology (MAMCA) for the evaluation of transport projects: Theory and practice. *Journal of Advanced transportation, 43*(2), 183-202.

Macharis, C., Turcksin, L., & Lebeau, K. (2012). Multi actor multi criteria analysis (MAMCA) as a tool to support sustainable decisions: State of use. *Decision Support Systems, 54*(1), 610–620. doi:https://doi.org/10.1016/j.dss.2012.08.008

te Boveldt, G. (2019). All aboard? A new evaluation approach for institutionally complex transport projects. . Brussels: VUBPress. doi: 10.1016/S0262-4079(17)31776-1.

Annex 1: T4.3 Data collection templates

The example of the filled-in questionnaire in Polish of past-pilot survey.



1. Jak często zdarza się, że zatoka przeładunkowa jest zajęta przy niezaplanowanym przeładunku?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
							X		

2. Jak Pani/Pan ocenia redukcję czasu przejazdów w przypadku możliwości rezerwacji zatoki do przeładunku?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
					X				

3. W jakim stopniu możliwość rezerwacji redukuje czas manewrowania?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
					X				

4. W jakim stopniu możliwość rezerwacji redukuje konieczność kolejnego przyjazdu na miejsce rozładunku?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
					X				

5. W jakim stopniu możliwość rezerwacji zatok redukuje ruch pojazdów dostawczych?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
	X								

6. W jakim stopniu możliwość rezerwacji zatok redukuje poziom hałasu?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
	X								

7. W jakim stopniu możliwość rezerwacji zatok redukuje poziom zanieczyszczeń?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
		X							

8. W jakim stopniu możliwość rezerwacji zatok poprawia bezpieczeństwo?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
	X								

9. Jaka część przeładunków wykonywanych jest na zatokach, w według Pani/Pana opinii?

0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
		X							

10. Jak często aplikacja stwarzała problemy (brak dostępu, błąd etc.)?

Bardzo często	Często	Rzadko	Wcale
		X	

11. Co można poprawić w aplikacji, według Pani/Pana opinii?

bez konieczności rejestracji

12. Co można poprawić w całym rozwiązaniu, według Pani/Pana opinii?

—

13. Czy będzie Pani/Pan używać aplikacji, jeśli zostanie ona w pełni wdrożona?

nie wiem

14. Reprezentowana grupa interesariuszy

Odbiorca dostaw	Kierowca	Mieszkaniec	Pracownik instytucji miejskiej	Inny – kto?
X				

The translation of asked questions:

1. *How often does it happen that a reloading bay is occupied when unplanned reloading takes place?*
2. *How would you rate the reduction in travel time if a reloading bays can be booked?*
3. *To what extent does the ability to book the bays reduce maneuvering time?*
4. *To what extent does a booking ability reduce the need for subsequent visits to the unloading site?*
5. *To what extent does a bay reservation option reduce cargo traffic?*
6. *How far does a bays booking ability reduce noise?*
7. *How far does a bays booking ability reduce pollution?*
8. *How far does a bays booking ability improve safety?*

9. *What proportion of reloading is carried out at the bays, in your opinion?*
10. *How often has the application caused problems (lack of access, error etc.)?*
11. *What could be improved in the application, in your opinion?*
12. *What could be improved in the whole solution, in your opinion?*
13. *Will you use the application, if it is fully implemented?*
14. *Represented stakeholders group: receiver of deliveries, driver, citizen, city institution employee,other?*

Annex 2: T4.4 Templates

Problem identification template- SIS step 1

Goal

- Develop a list of alternative policy responses for each pilot
    - Based on:
        - T3.3- Policy impact assessment of future urban mobility scenarios
        - T4.2- Results from the operational assessment of the pilots
- Prioritisation of alternative policy responses
    - Through multi-actor-multi-criteria analysis (MAMCA)

Input needed

In order to develop and prioritise the alternative policy responses, the answer to the following questions is needed:

1. What is the main problem you encounter in relations with your pilot?
2. What are the possible (policy) solutions to this problem?

An example could be as follows:

1. Main problem encountered: the integration of autonomous pods with surrounding traffic does not happen properly and creates dangerous situations.
2. Possible policy solutions:
    a. Making the area around the pods' path a 30km/h zone;
    b. Developing a smart traffic light system that favours the pods so that car traffic is halted when they need to cross.

In order to ensure the correct development of this Task 4.4, we need the **main issue** you encounter with your pilot, and at least 2 possible solutions to that issue. Of course, it is possible to offer more than 2 solutions as well.

The template below needs to be filled in and sent to **sara.marie.tori@vub.be** by **Oct. 30, 2020**.

Template

Please fill in the template below. If you have more than one regarding the pilot, feel free to add an extra item to the list. However, the first issue should be the **main one**.

Main issue with the pilot

- Description of the problem encountered:
- Description of the possible policy solutions to the problem:
    1. ...
    2. ...

Stakeholder criteria request for Kalisz- SIS step 3

Dear SPROUT stakeholders,

We are now a year and a half into the project. Up to now, we have inventoried the drivers of the transformations in urban mobility, and developed scenarios for the future of urban mobility in your city. To those of you who participated in the workshops to help build the scenarios, thank you again! You can take a look at the scenarios and their visualisations here (under the 'Resources' tab). As you may also know, pilot projects are now underway to test an innovative urban mobility solution in your city.

As part of the next step in the SPROUT project, we are looking at alternative policy responses for the pilots being implemented, based on issues that the SPROUT team uncovered during the implementation. This will be done through a modified multi-actor multi-criteria analysis (MAMCA), which is an evaluation that takes into consideration different stakeholders and their priorities.

As one of the first steps of the process, we need your input. We want to know what your objectives are with regards to your city's urban mobility environment, in terms of the pilot that is being implemented, in the next 10 years. Below, you will find two short descriptions of the pilot. The first is the pilot as it is today; the second description is a situation where policy changes have been implemented as a result of the pilot. What we would like to know from you is the following: if we were to implement the alternative, what factors are important in your eyes that we need to pay attention to? In other words, **what makes a good alternative better than a bad alternative**? These factors can be positive, but also negative. To give you an idea of what we mean, these are a few example criteria against which alternatives can be evaluated: traffic safety, cost, accessibility, air pollution, noise, impact on other transport modes, etc.

We ask you to send us **between 2 and 6 criteria** that are important to you by **January 4, 2021**.

Collecting your objectives is the first part of the MAMCA. Once we have all of them, we will get back in touch with you with a short survey for the actual evaluation process.

Best regards,

The SPROUT team

Scenarios:

1. Do-nothing alternative (the pilot as it is today): shared micromobility points without regulation for storing the vehicles
2. Shared micromobility points with regulation that requires public space designers to plan space to store shared micromobility vehicles within a specified zone, and that will define the number of dedicated spaces for shared micromobility devices

Expert evaluation form- SIS step 4

To be filled in by the scientific partners

Instructions:

In this phase of the Task 4.4 Multi-Actor Multi-Criteria analysis, we have collected local stakeholders' objectives with regards to your pilot. For this next step, we ask you to **evaluate the two scenarios** (the situation with and without the pilot) against these objectives. In order to do this, the table below lists all the stakeholder criteria that need to be evaluated. For each criterion, the following question needs to be answered: how does the second scenario (i.e. the scenario with the pilot implementation) score in terms of this objective? The drop-down menu allows you to choose between:

- Very negative;
- Negative;
- Slightly negative;
- No change;
- Slightly positive;
- Positive;
- Very positive.

For example: if I were to implement parcel lockers at a metro station, I could have the following evaluation:

- Very positive in terms of accessibility to customers (customers can now access their parcels any time they want);
- Negative in terms of financial feasibility (there is a cost associated with the implementation of the lockers).

In order for us to understand the evaluations, please write a (short) justification in the last column. If the evaluation is based on figures that are at your disposal, please also include those (for example, if you have a concrete implementation cost for the lockers in the example above, this needs to be added in the justification column).

Many thanks!

The Sprout Team

Stakeholder evaluation form Kalisz- SIS step 5

English

Intro and stakeholder group

You are invited to take part in a European funded project called SPROUT, which aims at developing innovative policy responses to urban mobility challenges. We ask you to fill in the following questionnaire as part of the stakeholder evaluation of the pilot of the smart loading bays in Kalisz. It will take no longer than 5 minutes. You can withdraw at any moment. By participating in the survey, you consent to use the data you provide in SPROUT and to make them publicly available in anonymised form. Your privacy will be respected in any case. For more information regarding SPROUT and the data you provide, please contact privacy@zlc.edu.es. Thank you very much for your collaboration.

To which of these stakeholder groups do you belong?

- ◯ Kalisz Municipality
- ◯ Infrastructure
- ◯ Business incubator
- ◯ School
- ◯ Entrepreneurs and companies
- ◯ Logistics service providers
- ◯ Shops and restaurants

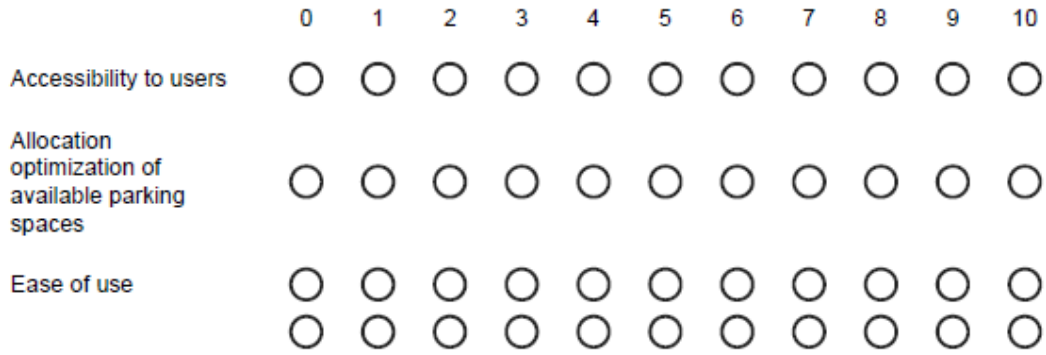
Kalisz Municipality

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).

	0	1	2	3	4	5	6	7	8	9	10
Increased road safety	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Ease of use	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Improvement in air quality	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Traffic reduction	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Adequacy of used technologies for research purposes	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

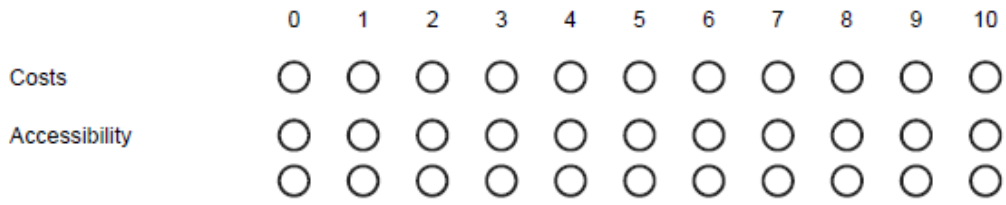
Infrastructure

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).



Business Incubator

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).



School

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).

	0	1	2	3	4	5	6	7	8	9	10
Adaptability to demand	○	○	○	○	○	○	○	○	○	○	○
Compatibility to city development plans	○	○	○	○	○	○	○	○	○	○	○
IT integration	○	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○	○

Entrepreneurs and companies

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).

	0	1	2	3	4	5	6	7	8	9	10
Ease of parking regulation enforcement	○	○	○	○	○	○	○	○	○	○	○
Improved accessibility to Logistics Service Providers	○	○	○	○	○	○	○	○	○	○	○

Logistics Service Providers

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).

	0	1	2	3	4	5	6	7	8	9	10
Ease of use	○	○	○	○	○	○	○	○	○	○	○
Allocation optimization of available parking spaces	○	○	○	○	○	○	○	○	○	○	○
Increased road safety	○	○	○	○	○	○	○	○	○	○	○

Shops and restaurants

Below you can see the criteria that you indicated as being important for a successful project. Please indicate how important you feel each criterion is for you, on a scale from 0 to 10 (0 = not important at all, 10 = extremely important).

	0	1	2	3	4	5	6	7	8	9	10
Ease of use	○	○	○	○	○	○	○	○	○	○	○
Adaptability to varying needs	○	○	○	○	○	○	○	○	○	○	○

Stakeholder ranking

Below you can see the different stakeholder groups that are impacted by or impact the Kalisz pilot. Please rank the stakeholder groups from most impacted (1) to least impacted (7).

Kalisz Municipality

Infrastructure

Business incubator

School

Entrepreneurs and companies

Logistics Services Providers

Shops and restaurants

Pilot improvement

How could the pilot be improved, in your opinion?

Do you see other alternative policy responses that could benefit the pilot implementation?

- ○ Yes
- ○ No

What other alternative policy responses do you think could benefit the pilot implementation?

Conclusion

Thank you for your answers!

If you have any questions, don't hesitate to get in touch with us!
sara.marie.tori@vub.be
geert.te.boveldt@vub.be

If you are interested in staying up to date with the SPROUT project, visit sprout-civitas.eu.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grand agreement No 814910.

Annex 3: T4.5 Implementation feasibility

Implementation feasibility: First stage

Technical feasibility dimension aims at assessing the pool of resources that each of the alternative policy responses requires.

According to the opinion of the involved stakeholders, the policy measure PM3 represents a critical alternative from the aspect of technical feasibility since its average rating value (5-tier scale) falls slightly below the 2.5 threshold (Figure 19).

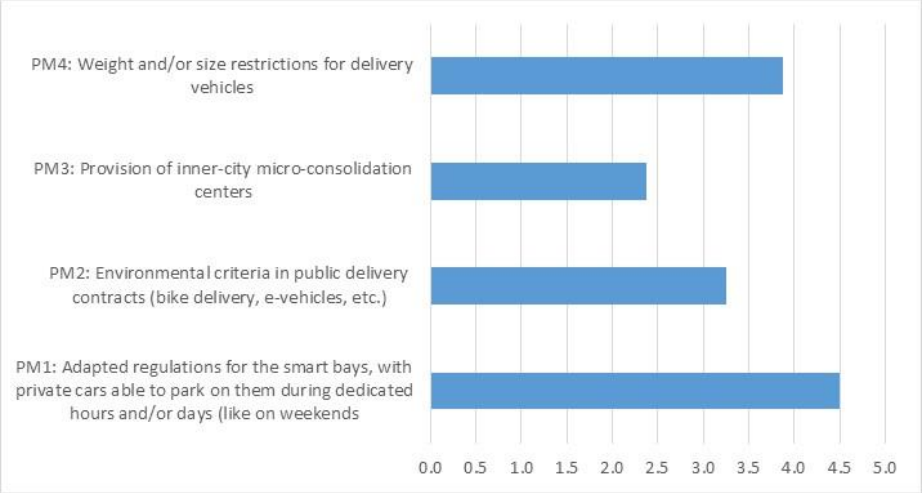


Figure 19. Assessment of policy measures against the technical feasibility dimension

In order to assess potential risks as well as the risk mitigation strategies for the implementation of PM3 from the technical feasibility aspect a round table will be organized.

Financial feasibility includes evaluation of following cost categories: direct costs, indirect costs, fixed costs as well as operations and maintenance costs; as well as the selected benefit categories: direct and indirect benefits.

According to respondent opinions (Figure 20 - Figure 25) the following conclusions are derived:

1. From the aspect of direct, indirect and fixed costs PM2 requires additional analysis;
2. From the aspect of operations and maintenance costs PM1, PM2 and PM4 require additional attention;
3. From the aspect of direct and indirect benefits, all policy measure will produce positive outcomes.

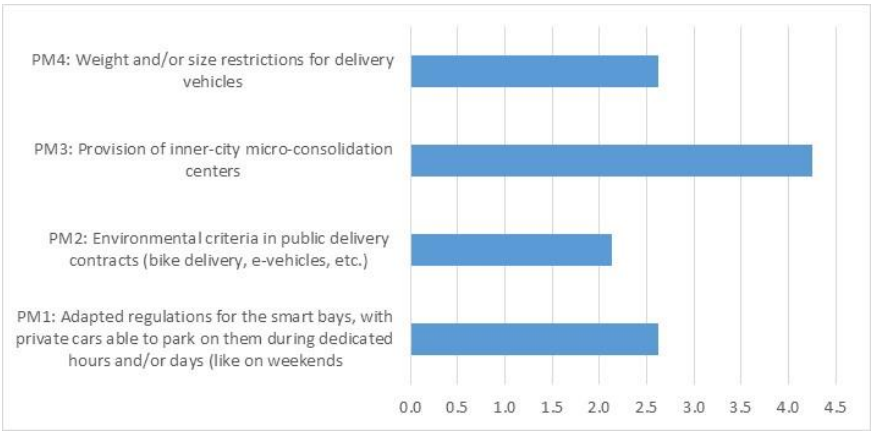


Figure 20. Assessment of policy measures against the financial feasibility dimension: Direct costs

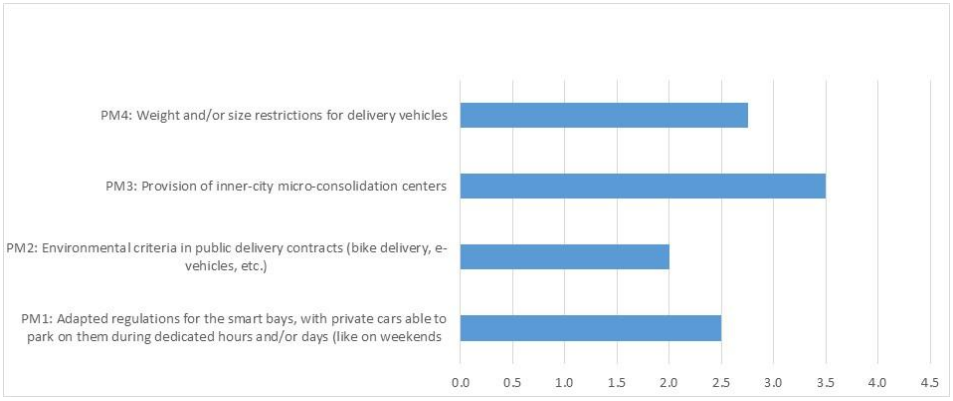


Figure 21. Assessment of policy measures against the financial feasibility dimension: Indirect costs

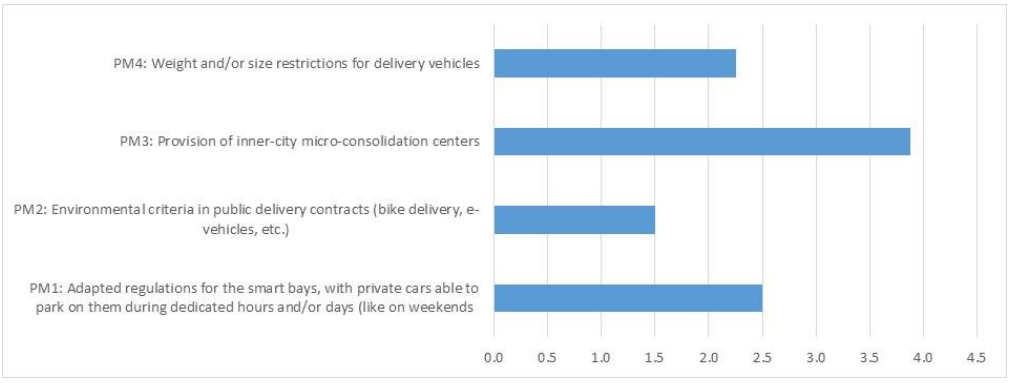


Figure 22. Assessment of policy measures against the financial feasibility dimension: Fixed costs

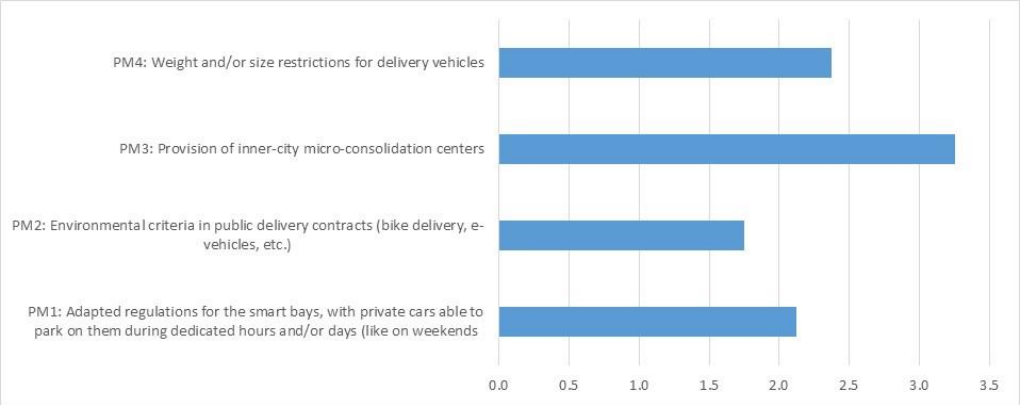


Figure 23. Assessment of policy measures against the financial feasibility dimension: Operations and maintenance costs

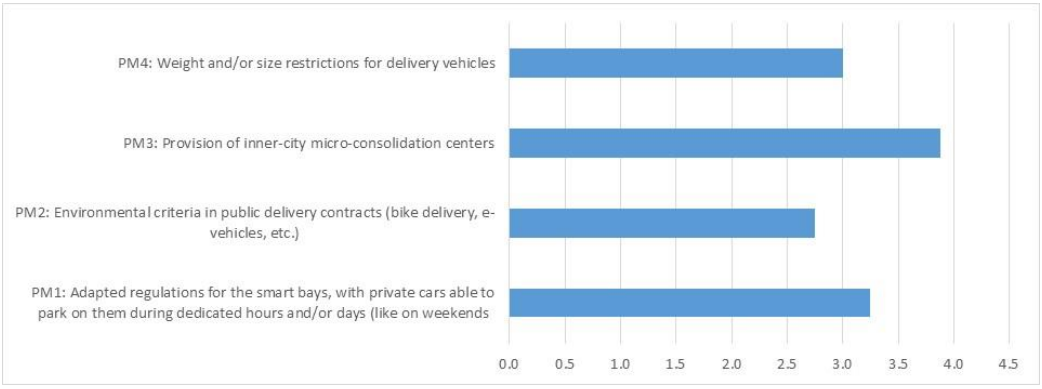


Figure 24. Assessment of policy measures against the financial feasibility dimension: Direct benefits

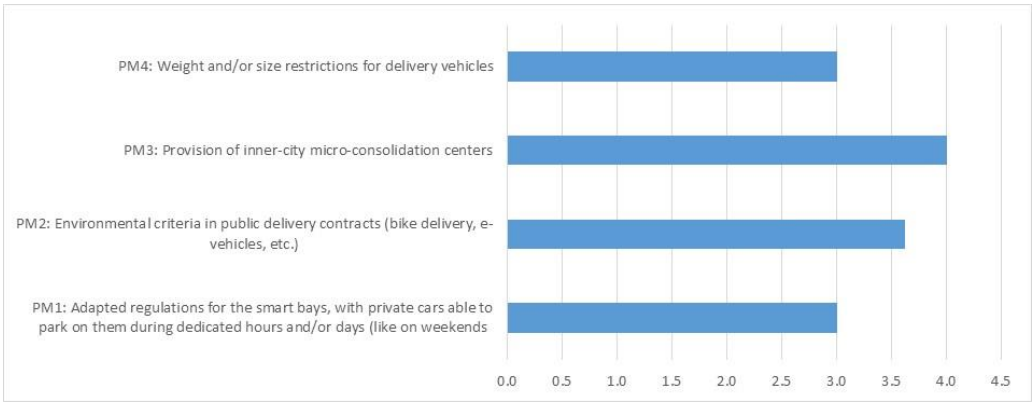


Figure 25. Assessment of policy measures against the financial feasibility dimension: Indirect benefits

Political feasibility includes evaluation of acceptability of alternative policy measures from the aspect of relevant stakeholders. The following conclusions are derived from the responses (Figure 26 – Figure 29):

- Urban logistics operators: PM2 and PM4 are not acceptable (mean ranking value is lower than threshold value);

- Public administration: All PMs are acceptable;
- Public sector stakeholder: All PMs are acceptable;
- Data/Tech companies: All PMs are acceptable.

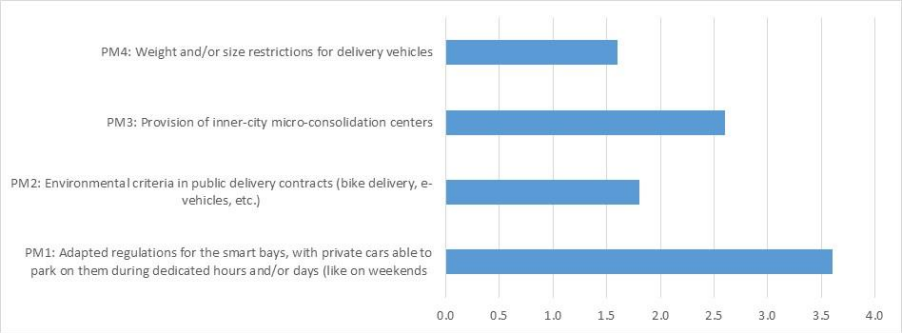


Figure 26. Acceptability of alternative policy measures from the aspect of Urban Logistics Operators.

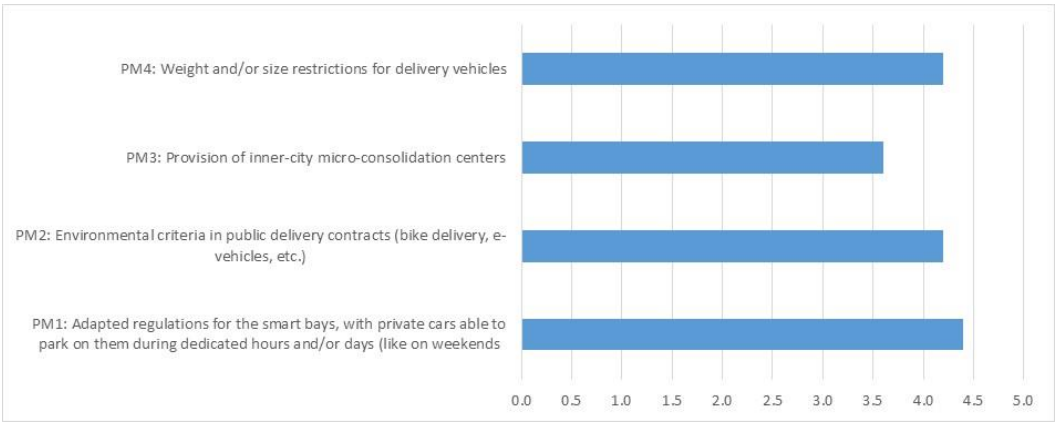


Figure 27. Acceptability of alternative policy measures from the aspect of Public Administration.

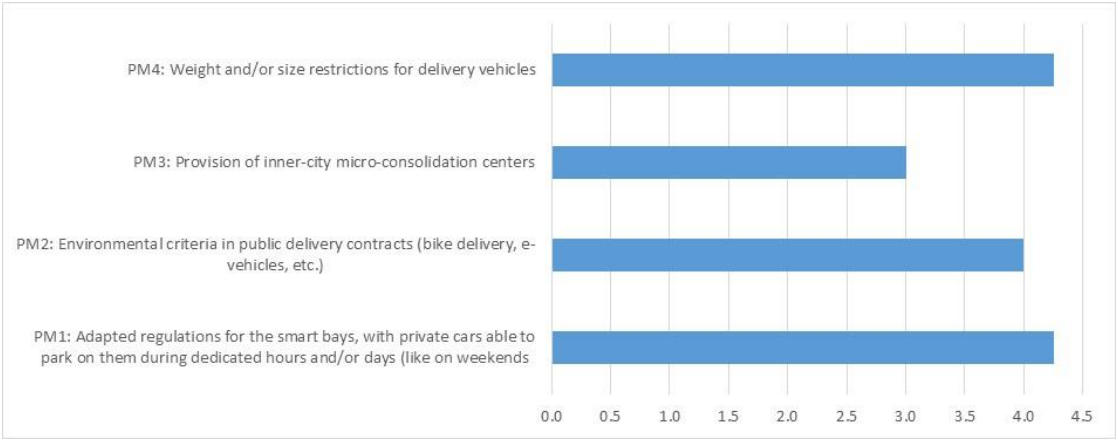


Figure 28. Acceptability of alternative policy measures from the aspect of Public sector stakeholder.

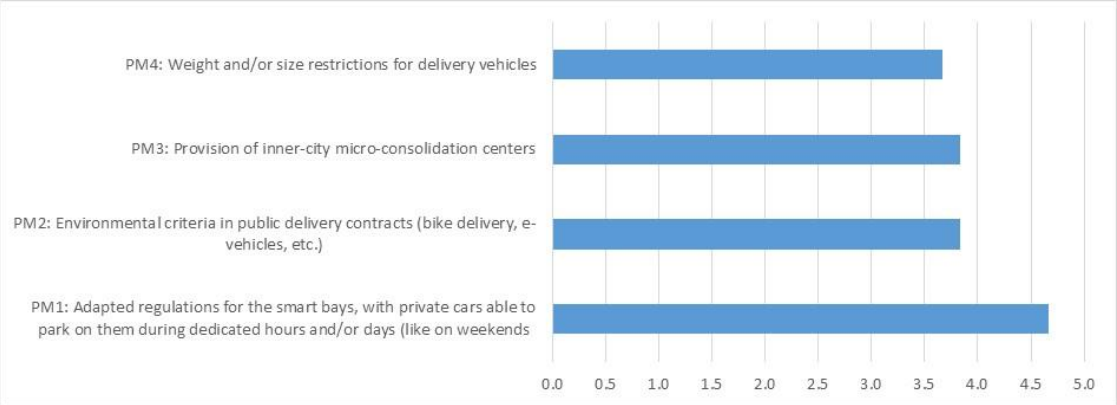


Figure 29. Acceptability of alternative policy measures from the aspect of Data/Tech companies.

Administrative operability and capability are the main criteria for assessment of policy measures against the political feasibility. According to the stakeholder responses (Figure 30 and Figure 31) the following conclusion is derived:

- From the aspect of administrative operability as well as administrative capability PM3 requires additional consideration.

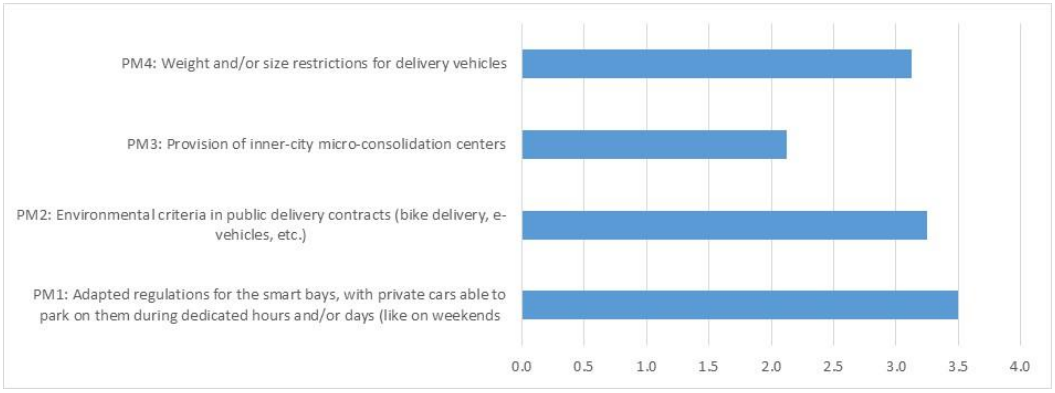


Figure 30. Assessment of policy measures against the political feasibility dimension: Administrative operability

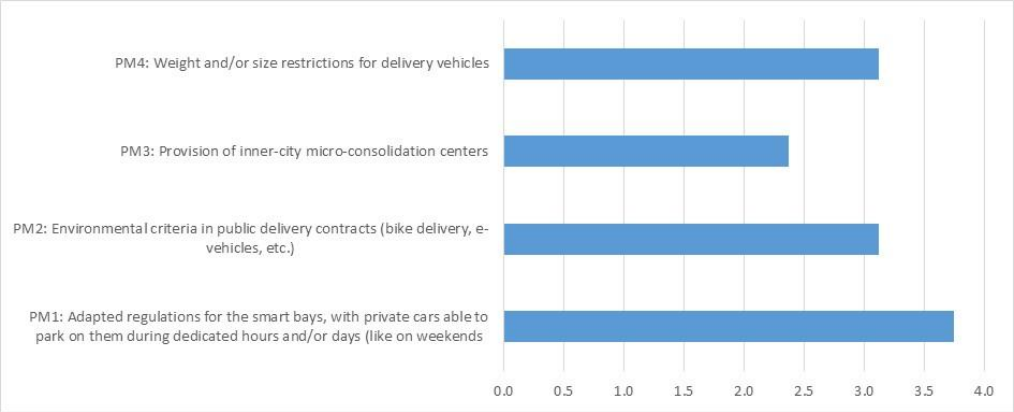


Figure 31. Assessment of policy measures against the political feasibility dimension: Administrative capability

Implementation feasibility: Second stage

Dimension/Criteria: Technical feasibility

Infeasible PM: Provision of inner-city micro-consolidation centers (PM3)

- **What is the technology really needed for implementation of PM3?**

To implement the inner-city micro-consolidation centres, an IT Platform is necessary, enabling the collection of data on planned deliveries, allowing for quick identification of deliveries at the place of transshipment and supporting effective consolidation of goods. It would be necessary to develop and implement specialized algorithms that would allow for quick planning of transshipments, selection of optimal routes and delivery vehicles. The IT solution should be easy to use for suppliers who delegate their supplies to such a micro-consolidation centre or even integrated with their own IT systems.
In micro-consolidation centres, technological solutions should be implemented to support picking, sorting, packaging and labelling of deliveries.
Additionally, dedicated visionary systems should be implemented, containing e.g. cameras, to enable to identify and prove at what stage of delivery the damage to the product occurred (in the event of a complaint).

- **How the lack of technology can be overcome?**

First of all, an *adequate storage infrastructure* should be provided. The city of Kalisz certainly does *not have sufficient warehouse space,* and there is also *no experience on how such a space should be organized.* The only possible option seems to be hiring of a business partner with the necessary technological and operational know-how. The problem of lack of knowledge and technology can be solved by finding a financing source and testing these solutions on a small scale. This would also allow the city's authorities to acquire the required experience and know-how. The potential

option would be to designate a sample area of the city and carry out a pilot. However most of the participants agreed that, the City does not have to acquire this knowledge on its own but should rather *outsource the service of micro-consolidation center to a specialized business partner*.

Dimension/Criteria: Financial feasibility/direct, indirect and fixed costs

Infeasible PM: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.) (PM2)

- **What are the direct, indirect and fixed costs in case of PM2?**

Introducing of environmental criteria would increase the costs of services purchased by public administration. The service suppliers would have to modify and adapt their vehicle fleet towards more environmental which would increase their costs heavily. Introducing a requirement that deliveries must be made exclusively by environmentally friendly transport could be too high of an entry barrier. The city could have problems gaining suppliers willing to perform the contract. The logistics infrastructure of individual suppliers is not yet prepared to meet such requirements. Public administration units, such as offices, hospitals, schools, could introduce "soft" incentives within their orders, additionally rewarding suppliers that meet the green delivery expectations.
It has been agreed relevant for public administration to gradually start promoting environmental friendliness and assume higher budget enabling higher prices for environmentally-friendly contracts - suppliers who choose to modify their fleet are likely to increase their prices to compensate for incurred costs.

- **Will these costs be outbalanced by the benefits of PM2?**

The benefits will primarily include promotion of health If the solution is implemented on a large scale and becomes common, it will help to significantly reduce emissions in the city. A healthier society also means lower spending on health care and medicines over the long term. These types of benefits are very important, but at the same time difficult to measure. The costs will be beard mainly by the suppliers, and inhabitants will benefit.
It would be good to define indicators, e.g. for assessing air purity, noise level or the amount of emissions, and to measure them regularly. This way it will be possible to realistically assess the potential benefit and compare it with the costs. To answer this question sufficiently it requires determination of KPIs and monitoring of changes. It is certain, however, that it requires a long period of time for the benefits to outweigh the costs (perspective of years).

Dimension/Criteria: Financial feasibility/operations and maintenance costs

Infeasible PM: Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends) (PM1)

- **What are the real operations and maintenance costs in case of PM1?**

The costs should not be high. As proved by the Kalisz pilot, after purchasing and installation of components and the development of the application as part of the pilot, no high maintenance costs occurred. However, there were problems with physical damage to the sensors. It should be therefore assumed that periodic replacement of these elements will be necessary (their costs are low). Additionally, for the system to function efficiently, it is necessary to regularly monitor whether the sensors are damaged or working - the cost of this control is assumed also the maintenance cost. To fully use the potential of the solution, it would also be useful to hire an analyst responsible for carrying out parking space occupancy analysis and creating dashboards and statistics for decision-makers.
The operating costs also include supervision of compliance with the regulations. Unless physical barriers are introduced, such as barriers that open when the identity or registration number of the vehicle is confirmed, it will be necessary to carry out inspections by the municipal police or other entity. It should be checked:
- whether the car that is occupying the parking space has made the reservation,
- whether the fee has been paid,
- if private cars do not occupy parking spaces during the hours reserved for delivery vehicles.

- **Which party will be responsible for operations and maintenance costs for PM1?**

Municipality (city budget).

- **How this cost burden can be reduced?**

It is possible to develop an IT solution that will automatically generate standardized reports and dashboards to analyse and manage the system of unloading bays. Certainly, the city should buy the most durable sensors (resistant to weather conditions and mechanical damage) and place them in such a way that they will not be damaged by vehicles, e.g. snow blowers (if possible). Installing the sensors below the pavement level would be rather too expensive.

- **Will these costs be outbalanced by the benefits of considered PMs?**

Definitely yes. However, one should imagine a large-scale implementation and do not assess the benefits by looking at a small-scale pilot implementation. The advantage is that the driver drives directly to a parking space that is already reserved. Fewer vehicles will be circling the centre in search of a suitable parking space. As a result, traffic congestion, especially in the city centre, will decrease, as well as car operating

costs and the likelihood of road accidents. With a large scale of implementation, drivers will be able to better plan deliveries and stops in the city. The financial benefits for the city (additional budget revenues) are unlikely to be significantly higher, but the social and environmental benefits will play a significant role.

Infeasible PM: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.) (PM2)

- **What are the real operations and maintenance costs in case of PM2?**

A significant cost will be the need for contractors to replace the existing vehicle fleet with an environmentally friendly one. Electric vehicles are expensive, so suppliers will have to make large investments to respond to inquiries. The costs will have to be partially passed on to public entities. If suppliers decide to deliver goods with low-emission vehicles, they will propose higher prices in the contract. The difference between the current supply price and the new prices for the use of low-emission vehicles will be a direct cost to the public administration. To sum up, the most significant cost of this policy measure will be the cost of the fleet replacement and the cost borne by the administration (passing on the cost of fleet replacement to customers).

- **Which party will be responsible for operations and maintenance costs for PM2?**

Logistics operators/providers and public administration.

- **How this cost burden can be reduced?**

There is no solution. Probability to reduce costs in a short period of time is hard to find.

- **Will these costs be outbalanced by the benefits of considered PMs?**

According to the Stakeholders, the achieved benefits will not exceed the costs. The environmental benefits are difficult to quantify. The volume of supplies to the public sector is relatively small, so the benefits will not be spectacular either. Therefore, it is difficult to conclude that these benefits will compensate for the costs of a huge investment - the purchase of a new fleet. If all goods in the city were delivered by environmentally-friendly vehicles, the benefits would be much greater, and it might be worthwhile to introduce changes.

Infeasible PM: Weight and/or size restrictions for delivery vehicles (PM4)

- **What are the real operations and maintenance costs in case of PM4?**

If the vehicle sizes and weights allowed in the city are decreased, more transports and vehicles will be needed to handle the same volume of deliveries. Therefore, all direct costs for operators will be much higher (even two to three times). An additional cost for the operator is the need to exclude non-compliant vehicles from their fleet on individual routes. For the city, the introduction of this policy measure will not incur any additional costs, except for the cost of appropriate street marking and street signs.

- **Which party will be responsible for operations and maintenance costs for PM4?**

Only operators who have a fleet that exceeds the permissible dimensions and use it within the city.

- **How this cost burden can be reduced?**

Gradual introduction of such rules so that operators can gradually replace the fleet or announce it well in advance or by applying transitional arrangements. Operators will be able to adjust new purchases and leasing according to the new regulations.

- **Will these costs be outbalanced by the benefits of considered PM?**

The benefits are higher than the costs. These are social and environmental benefits such as better air quality, lower noise and improved quality of life. On the other hand, the urban infrastructure will be less loaded and exploited. With a high smaller cars usage, there will be naturally fewer roads to repair. Social benefits are important because the City Center should meet social needs, e.g. available parking spaces for residents. Vans parked or moving in the City Center are a significant problem. Residents do not come to the centre in order to rest and to spend their free time because it becomes unpleasant. The experience of Western cities has shown that introducing such zones in the City Center with a restriction for large delivery vehicles allowed the centre to develop towards more social environment.

Dimension/Criteria: Political feasibility/Urban logistics operators

Infeasible PM: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.) (PM2)

- **What are the reasons for unacceptability of PM2 by the Urban logistics operators?**

The reason why this policy measure is unacceptable by city logistics operators is the high costs that have to be incurred to meet the environmental criteria. Currently, operators are not commonly equipped with low-emission vehicles, cargo bikes and

other similar solutions. Deliveries with smaller vehicles, such as cargo bikes, additionally mean a much lower load capacity, and this requires a significant reorganization of the logistics processes carried out so far. Every change, every limitation has a huge impact on logistics and transport planning.

- **What are the measures that could be applied for overcoming/reducing the acceptability barriers by urban logistics operators?**

Public administration units could support such operators in terms of promotion. For example, on their websites or in social media, they could place information about the applied ecological solutions and, consequently, promote a given supplier as an ecological supplier. A supplier who meets the criteria will know that it increases its potential to attract more contractors. It would be helpful if the public institutions that announce tenders declared that this is not a one-off requirement, but a trend that the city is heading. If the supplier considers a fleet modification, it should be clear that this is not a criterion that is valid exclusively for this contract, but also for the next ones. If the supplier are to bear the costs, it has to be ensured that it is not for one contractor only. To succed the practice of including environmental factors in most public contracts would pursue this change.

Infeasible PM: Weight and/or size restrictions for delivery vehicles (PM4)

- **What are the reasons for unacceptability of PM4 by the Urban logistics operators?**

In this case, as in the previous one, the costs that would have to be borne by logistics operators are the cause of the unacceptability of the proposed solution. Some operators would be forced to modify their vehicle fleet, redesign standard routes, and make changes to the planning of logistics operations to avoid penalties for using overly large or heavy vehicles in restricted areas. Smaller vehicles also have a lower payload, which means more courses and higher operating costs (vehicle wear, fuel costs, etc.).

- **What are the measures that could be applied for overcoming/reducing the acceptability barriers by urban logistics operators?**

Compromise is always difficult, but also always possible. In this case, the solution may be a gradual approach to the final solution. Example: The city imposes an entry ban on a given street for vehicles over 3.5 tons, but in the first phase, the ban applies only during certain hours. It is not a perfect solution, but it is a compromise. The risk of doing so is that it could have a negative impact on traffic and congestion if all large vans are on the roads at the same time. Therefore, it would be advisable to test the solution and set a range of hours that will not cause communication problems. Such a pilot is a good option for testing and verification of the idea if a given solution can be introduced on a wider scale.

Dimension/Criteria: Administrative feasibility/administrative operability & administrative capability

Infeasible PM: Environmental criteria in public delivery contracts (bike delivery, e-vehicles, etc.) (PM2)

- **Does the public authority have the resources to implement the PM2?**

Public entities have the necessary resources to implement the environmental criteria. It is connected only with adding appropriate content to announced tenders and concluded contacts.

- **Does the public body have the authority to implement the PM2?**

Public procurement is governed by the law. Not all criteria are indeed admissible ("exclusion" criteria cannot be applied), but there is a great deal of freedom in terms of criteria in public procurement. The only potential difficulty is that the public entity issuing the tender may not be confident in applying the criteria and in defending those criteria, for example in court (in the event of a dispute). There may also be concerns that after the introduction of such criteria, tenders will not be concluded or

will be more difficult to settle. The risk is also potentially higher prices, overburdening the budget.

- **To what extent the PM2 has the commitment of different decision maker levels?**

The entity responsible for introducing the criteria is a given unit, the question is how autonomous individuals are. The president tries to manage the city in a participatory manner and consults certain decisions with his subordinates. If each public entity were to make a decision to apply environmental criteria on its behalf, it does not require approval by many decision-makers. However, if it was to be a top-down regulation at the level of all public units in a given city, it would require a lot of involvement of the city authorities and numerous consultations.

Annex 4: T4.5 User acceptance

User acceptance: First stage

Criteria “Personal and social aims” is assessed by the extent a specific PM fulfills the needs of the respondents. According to the survey results (Figure 32) all PM1, PM2 and PM4 are fully reflecting the social and personal aims of the users whereas the PM3 requires additional attention.

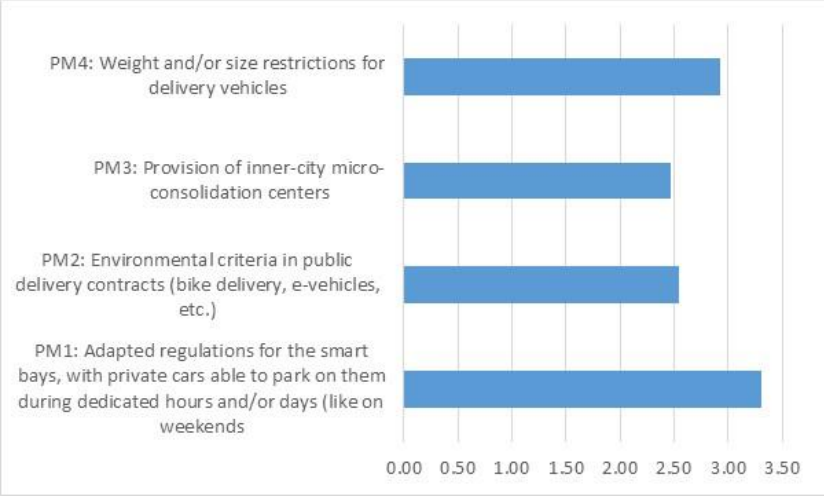


Figure 32. Assessment of policy measures against the user’ personal and social aims

High problem perception reflects an increased willingness to accept a specific policy measure. The following problems are identified in Kalisz’ environment: safety, congestion, air pollution, efficiency of last mile distribution. According to the survey results (Figure 33) the user’ perception of the efficiency of last mile distribution should be increased.

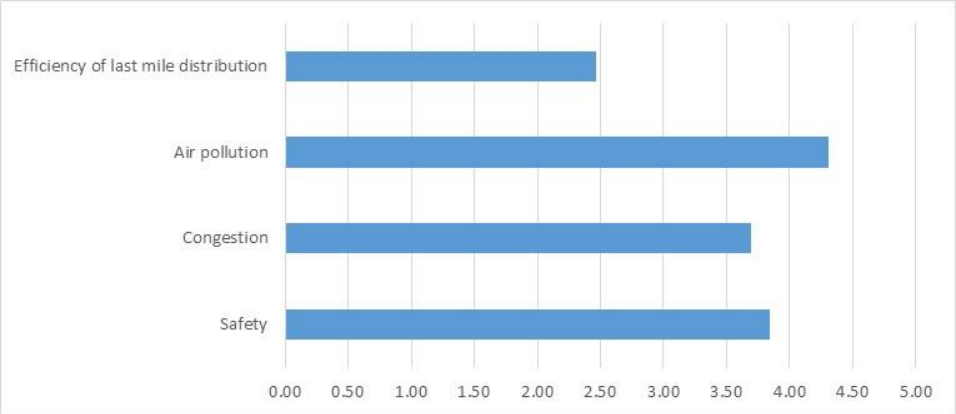


Figure 33. Assessment of policy measures against the user' problem perception

Problem perception is supported by the level of a potential user' knowledge about a specific urban mobility problem. The better the users are informed the higher the acceptance will be. According to the survey results a greater emphasis should be allocated to empowering the potential users with additional information and knowledge about the efficiency of last mile distribution.

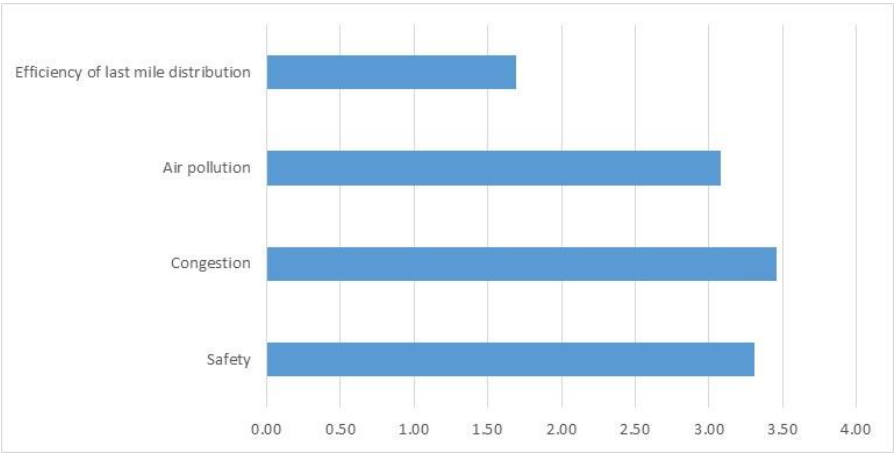


Figure 34. Assessment of policy measures against the user' problem awareness

Information and knowledge about the alternative policy measures that can be introduced to reduce or eliminate the negative effects of the problem is an additional user' attribute that can impact on its preference. The survey results show the users should be better informed about the essence of PM3.

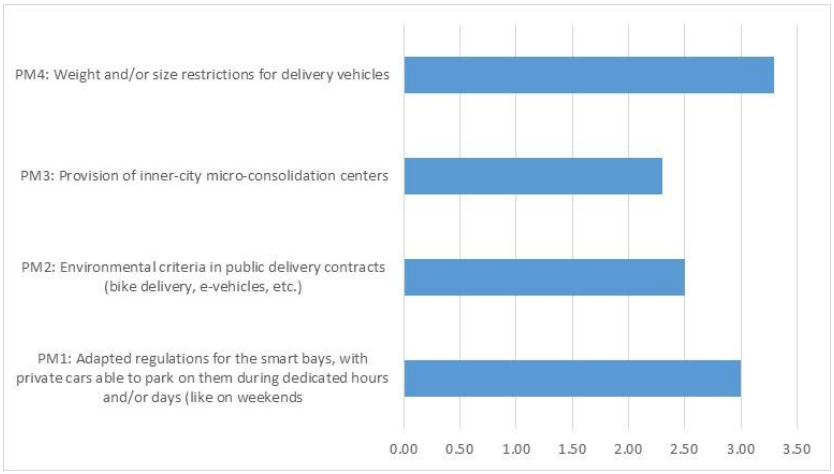


Figure 35. Assessment of policy measures against the user' awareness about policy measure

User' satisfaction with proposed solution, policy measure in this case, reflect the degree by which the policy measure solves the users' needs. According to the survey results the users are very satisfied with proposed policy measures.

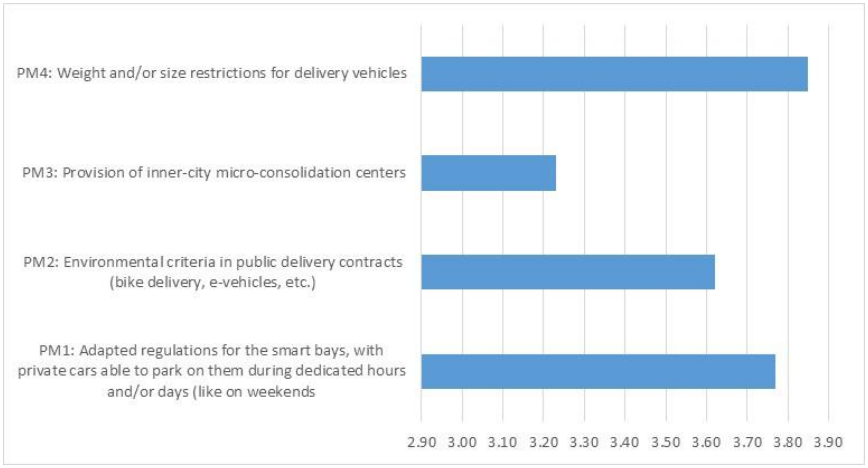


Figure 36. Assessment of policy measures against the user' satisfaction with a policy measure

Affordability of the policy measures from user perspective is also one of the determinants of the success of a specific policy measure. Based on its socio-economic status the users express their preference towards a specific policy measure. The survey results show that PM1 requires additional consideration in terms of users' affordability.

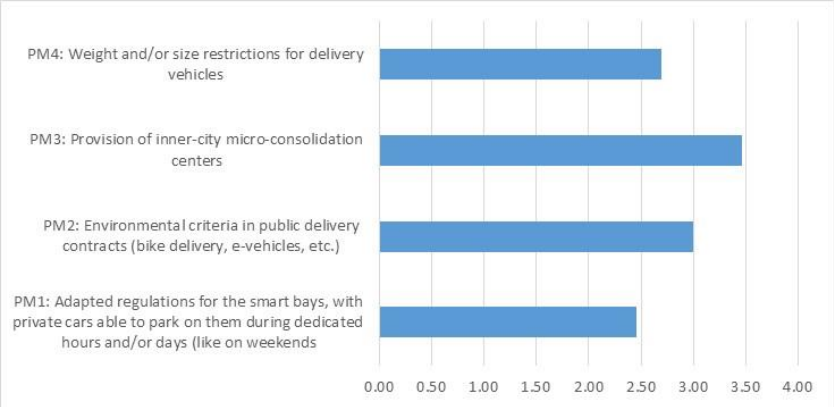


Figure 37. Assessment of policy measures against the users' affordability of policy measures

User acceptance: Second stage

Criteria: Personal and social aims

Subject of unacceptance (PM or problem): Provision of inner-city micro-consolidation centres (PM3);

- **How can the gap between the real effects of PM3 and social and personal aims be reduced/eliminated?**

Probably this gap is due to the lack of knowledge of the inhabitants (individual users and local businesses) how they could benefit from the introduction of inner-city micro-consolidation centres. The concept of creating such centres had not been widely disseminated in Kalisz before, some people do not understand the phrase "micro-consolidation centre". Perhaps some respondents wrongly concluded that such a solution would cause more traffic in the city and reduce the available space (new infrastructure and more vehicles around the city). The solution for this problem is education, information campaigns, presenting the benefits from the point of view of city residents and businesses. Stakeholders need to find out that this solution can significantly reduce traffic in the city centre, pollution from gas emissions, traffic jams. In turn, a business must obtain information that deliveries will be more convenient and less time-consuming for them (all ordered goods will be delivered within one delivery).

Criteria: Problem perception

Subject of unacceptance (PM or problem): Efficiency of last mile distribution

- **How to increase the users' perception about last mile distribution?**

Education and informing the public about last-mile distribution, how it is burdening the city and what solutions are needed to improve this situation. Distribution in the

last stage has a significant impact on the final price of the product, therefore effective distribution in the last stage may be associated with a lower price of the ordered goods - the citizens should be educated about this. The perceived solutions are primarily education and raising awareness through advertising campaigns, meetings with the media, raising awareness in schools and universities. It can also be information published on local government portals, Facebook and other social media. Information should come from those institutions that care the most.

Criteria: Problem awareness

Subject of unacceptance (PM or problem): Efficiency of last mile distribution

- **How to increase the users' awareness about last mile distribution?**

Information campaigns on various channels (aimed at reaching the widest possible audience) are a potential solution. Examples of communication channels: advertising spots on local TV, websites, series of posts on facebook. The campaign should increase the knowledge about which solutions are beneficial from the point of view of last mile distribution, and thus beneficial for the city and society. People are not aware of the cost of last mile logistics. Another proposal is to create a report and publish it on the city's website - presenting how the last mile translates into the cost of goods and what behaviors, choices, technologies allow to increase the efficiency of last mile distribution. This report should be promoted by the City Council. Pro-ecological campaigns are paying off, this is due to a study conducted by the Łukasiewicz-ILiM Logistics Center. Online store customers more often choose stores that offer eco-friendly delivery. This is due to the fact that people are becoming more and more aware of this rightness of pro-ecological attitudes. In the case of last mile distribution, carrying out an information campaign could also raise public awareness.

Criteria: Information and knowledge about

Subject of unacceptance (PM or problem): Provision of inner-city micro-consolidation centres (PM3)

- **How users can be better informed about the effects of PM3 implementation?**

The city should focus on communication through information channels such as Facebook and the Kalisz website. There is also the Kalisz Entrepreneurship Incubator operating in the city, which could disseminate knowledge and help entrepreneurs to learn about micro-consolidation centres. Cooperation with organizations associating business may also be helpful, such as the food cluster, aviation cluster, furniture cluster, and the Regional Chamber of Commerce. Information could also be disseminated in schools and universities. In conclusion - diversification is the key to success.
The solution could be a pilot project based on which a report and a business case would be created. Entrepreneurs participating in the pilot project could describe whether it was possible to achieve benefits from such a cooperation model and what these benefits were. Such an approach would increase credibility and confidence in the solution.

Criteria: Affordability

Subject of unacceptance (PM or problem): Adapted regulations for the smart bays, with private cars able to park on them during dedicated hours and/or days (like on weekends) (PM1)

- **What are the real costs of PM1 for the user?**

In practice, the costs will be the same as in the case of parking in "standard" parking spaces in the city centre. The rating "potentially expensive" is likely a result of the fact that the target pricing policy for the large-scale implementation of unloading/parking bays was not clearly communicated, so users assessed that by increased prices. Currently, the residents of the City Center can purchase subscription cards at attractive prices. Other residents of Kalisz can also buy them - at a slightly higher, but still attractive price. If these cards were accepted when using smart bays - the price for an individual user would not change.

An additional factor that influenced the cost assessment for the user is the fact that currently some suppliers, couriers, park for a very short period of time and do not pay parking fees. The risk of being fined when parking for a few minutes is very low. In the case of the introduction of smart bays and a data collection application, avoiding the fee will be more difficult in the opinion of users. There may be a fear of obligatory

fees, while now these fees can be avoided. If someone, by definition, did not pay (because a few minutes parking slot), it may be an additional cost in his opinion.

- **How can these costs be overcome (or gradually introduced)?**

The residents need to be able to use the already implemented solutions (Kalisz resident card) - it would reduce the costs for the user.
It was proposed to create a subscription system that would provide much convenience and save users time. Users, who often use intelligent unloading bays, would not have to spend time each time paying the parking fee, and the price would be fixed, regardless of the number of bookings.

Lowering parking prices in the initial stage after implementation was assessed as a risky solution - people get used to prices quickly, so raising them could be associated with widespread dissatisfaction.
In the opinion of the workshop participants, it should be emphasized that intelligent unloading bays allow, above all, to save time while maintaining similar costs.