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Co-funded by the European Union

OPTI-UP

D.2.2.1 – COMPREHENSIVE EVALUATION REPORT AND RECOMMENDATIONS FOR THEMATIC SOLUTIONS SCALING UP

Version 2.0

April 2026

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Abbreviations

CO_2	Carbon Dioxide
DRT	Demand-Responsive Transport
GTFS	General Transit Feed Specification
KPI	Key Performance Indicator
PA	Pilot Action
PP/AP	Project Partner/Associated Partner
P+R	Park and Ride
PT	Public Transport
PTO	Public Transport Operator
WP	Work Package

1. Overview

1.1. General

Deliverable D.2.2.1 presents a comprehensive evaluation of OPTI-UP pilot actions, including recommendations for scaling up the pilot solutions. It provides a consolidated overview of the overall results and key findings of the pilot actions. The report presents and evaluates the outcomes of pilot action monitoring activities and includes comparison of the results across the pilot actions and their strengths and weaknesses, together with financial and operational recommendations to support their scale-up.

This pilot action monitoring report has been prepared within the framework of OPTI-UP Activity 2.2, *"Monitoring and Analysing Performance Data of Public Transport Pilot Actions."*

The report sets out conclusions at the individual pilot action level, as well as comprehensive conclusions and assessment at the level of the pilot solutions (demand-responsive transport, public transport network optimisation, and alternative fuel technologies) and across all pilot actions.

Deliverable D.2.2.1 reports on:

- on-site monitoring and insights from the implementation of OPTI-UP pilot actions, including comprehensive conclusions;
- monitoring and evaluation of pilot action performance based on KPIs, supported by a comprehensive analysis of the OPTI-UP pilot actions;
- analysis of users' satisfaction with the implemented pilot solutions, including a comprehensive assessment and user-based recommendations;
- key outcomes of the OPTI-UP pilot actions, together with financial and operational recommendations for the scale-up and transferability of each pilot action, as well as comprehensive conclusions for the pilot solutions; and
- comprehensive conclusions on pilot action implementation and performance.

The comprehensive report draws on input documents prepared by all partners responsible for the implementation of the pilot actions, developed during or after the implementation period of the respective pilot actions:

- pilot action plans
- pilot action implementation monitoring
- pilot action implementation report
- KPI data collection and monitoring tool
- pilot action site visit report
- users' satisfaction survey report
- pilot action KPI monitoring report, and
- stakeholders' consultation report.

This document is structured in two parts. The first part constitutes the main report and includes a comparative analysis and comprehensive conclusions across all six OPTI-UP pilot actions.

The second part is provided as a separate appendix document. The appendix contains, for each pilot area, reports related to Activity 2.1, including detailed analyses of site visits, KPI performance assessments, user satisfaction surveys, and stakeholder consultations. The appendix is organised into six sections corresponding to the pilot action areas: A: Modena, B: Grosuplje, C: Paks, D: Osijek, E: Pécs, and F: Český Krumlov.

1.2. Summary of OPTI-UP pilot project areas and actions

The OPTI-UP project aims to optimize public transport (PT) in small and medium-sized cities across Central Europe by integrating it with urban planning and data-driven approaches. Tailored PT optimization solutions have been proposed for six pilot project areas within the OPTI-UP project.

Pilot actions have implemented six optimization solutions across three thematic fields.

The **Demand-Responsive Transport (DRT)** thematic field focuses on providing flexible public transport (PT) services to low-demand areas, aiming to balance accessibility with financial sustainability. Different DRT strategies were piloted in

- Modena (Italy): *booking of DRT by using a mobile app; based on pre-defined list of available DRT service stop points and bookings the optimal route has been proposed by the app; the passengers were informed on schedules (pick-up time at starting point and drop off at destination point; DRT service is operated by minibus.*

and

- Grosuplje (Slovenia): *DRT was operated on a fixed schedule – fixed trips; the trip was operated if at least one passenger has been registered through the call centre; the operated PT vehicle was selected according to the number of registered users: bus, van or car; van and car are electrically propelled.*

The **Public Transport (PT) Network Optimization** thematic field involves adjusting the routes and schedules of the existing PT system, which were piloted in:

- Osijek (Croatia): *introduction of a new bus line between Višnjevac and Đakovština, connecting densely populated area with a big industrial zone; currently, no PT line available;*

and

- Paks (Hungary): *introduction of a new bus line between Gesztenyés utca stop and the newly established "PK telephely" stop in the Paks, serving three intermediate stops, in order to connect residential & office area, previously not connected to the city's PT network.*

The **Alternative Fuel Technologies** thematic field focuses on testing the impact of electric propulsion vehicles on energy efficiency and public transport (PT) ridership by enhancing comfort and cleanliness, both contributing to greater sustainability. These solutions were piloted in

- Pécs (Hungary): *new electric bus lines and stops to expand the PT network in the underserved area, offering a sustainable mobility alternative for employees; goals: providing reliable and direct connections, reduce car dependency, lower emissions, and support better access to jobs;*

and

- Český Krumlov (Czech Republic): *introduction of an electric minibus, connecting residential areas with the city centre and connecting with regional transport; modernizing public transport in cities with historic character and challenging terrain by employing environmentally friendly PT solution.*

All six pilot actions were implemented and monitored during the period from June 2025 to November 2025. After the official termination of pilot action monitoring, the pilot solutions continue to operate in Modena and Paks. The municipality of Pécs decided to maintain the new connection until June 2026.

Figure 1: Locations of pilot project area

To provide a clearer overview of the pilot project areas involved, some basic spatial and demographic characteristics are listed below:

- **Modena** is one of the main commercial centres in Emilia Romagna. It is in the Po Valley and has a population of 185,009 inhabitants; the entire province of Emilia-Romagna has 706,972 inhabitants and the country has 58,989,749 inhabitants.
- **Grosuplje** is a medium-sized Slovenian municipality located on the south-eastern edge of the Slovenian capital with a population of 21,870. The area that the demand-responsive transport (DRT) pilot will be conducted is the Polica settlement inside Grosuplje, which has a population of 2,092. Grosuplje belongs to the Ljubljana Urban Region, which unites 25 municipalities and has a population of 537,893.
- **Paks** is the second most populous city in Tolna county, accounting to 8.5% of the population of Tolna county. In terms of population density, however, it is one of the less populated district centres, accounting to its large area. Paks has a population of 17,827 (Jan 1, 2023), while Tolna County has a population of 99,933.
- **Osijek** is the fourth-largest city in Croatia, and its urban settlement has a population of 75,535. It is the largest city and the economic and cultural centre of the eastern Croatian region of Slavonia, as well as the administrative area. The administrative area of the city has a population of 96,313. Osijek-Baranja County has a population of 258,026.
- **Pécs** is the fifth largest city in Hungary and the capital of the Baranya region. It has a population of 140,422 inhabitants. The Baranya region has a population of 370,484. Hungary has a population of 9,584,627.
- **Český Krumlov** is a city located in the South Bohemian Region in Czechia. It has a population of 13,000 inhabitants, while the South Bohemian Region has a population of 640,000 inhabitants. Czechia has a population of 10,690,000 inhabitants.

2. On-site monitoring of pilot implementation

On-site monitoring of the implementation of OPTI-UP pilot actions was an important measure to ensure the planned PA solutions have been correctly implemented but also to get feedback on operation and use of the PT service. In particular, the monitoring of newly introduced public transport services through six PAs was crucial for identifying potential issues and enabling timely corrections and fine-tuning of services.

While pilot action performance was continuously monitored through KPI tracking and regular briefings with operational staff, at least one official site visit was carried out in each pilot action area by the responsible project partners, involving relevant stakeholders. All six site visits were organized during the PAs implementation in the period from July to October 2025.

The following sub-sections provide an overview of the official site visits to the six OPTI-UP pilot action areas and present the key on-site observations, while details are available in the listed sections of the appendix file ("D.2.2.1_OPTI-UP_COMPREHENSIVE EVALUATION REPORT_APPENDIX"):

- Appendix A: Pilot action in Modena,
- Appendix B: Pilot action in Grosuplje,
- Appendix C: Pilot action in Paks,
- Appendix D: Pilot action in Osijek,
- Appendix E: Pilot action in Pécs and
- Appendix F: Pilot action in Český Krumlov.

2.1. Participants

All six site visits were organised by the respective Pilot Action responsible partners and were attended by representatives of project partners, associated partners, and other relevant stakeholders. The table below presents the number of participants per pilot action and per participant category.

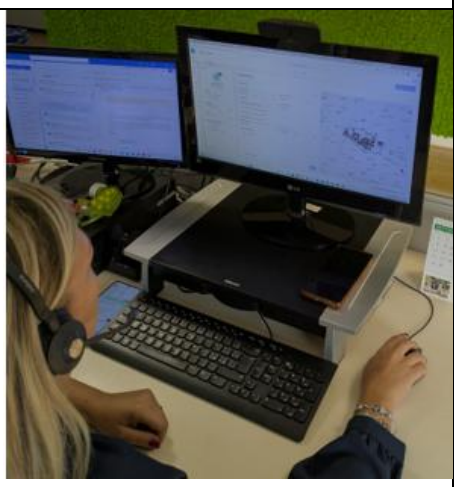
Table 1: Site visits participants

No.	OPTI-UP pilot action areas	Date of visit	Number of participants per type		
			Project Partner (PP)	Associated Partner (AP)	Other stakeholders
PA1	Modena	21.10.2025	2	4	-
PA2	Grosuplje	02.07.2025	2	1	2
PA3	Paks	01.09.2025	3	-	-
PA4	Osijek	09.10.2025	2	3	-
PA5	Pécs	12.11.2025	3	6	4
PA6	Český Krumlov	15.09.2025	3	-	1
Total		**36**	**15**	**14**	**7**

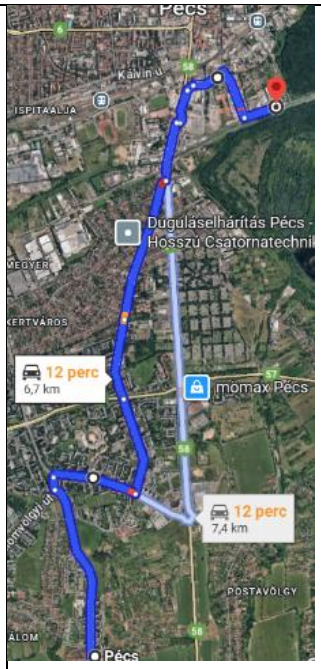
2.2. Site visit implementation

The overview below provides a concise summary of the site visits conducted at the pilot action locations, highlighting the main activities, discussions, and key implementation aspects observed during the visits for each pilot action.

Table 2: Overview of site visits

No.	OPTI-UP pilot action areas	Site visit implementation
PA1	Modena	The site visit included an office session at Hola, where the new DRT booking tools and backend system were presented. Feedback was collected from the call centre manager on tool functionality and user experience. A field visit was conducted at the upgraded "Panni" stop, improving the connection between the DRT service and the fixed-route network. Infrastructure improvements and service integration were discussed with the operator. Feedback was also gathered from a driver regarding the new onboard equipment used for managing trip assignments. 
PA2	Grosuplje	The site visit to the Grosuplje pilot area took place on 2 July 2025 as part of the preparatory activities for the DRT pilot on line 72. Four passengers had been pre-registered via the LPP call centre for the scheduled DRT ride. Participants travelled from Ljubljana by train, receiving an overview of the pilot action, Grosuplje, and the transport modelling behind the DRT concept. Upon arrival, the mayor welcomed the group and presented the railway station, the nearby P+R facility, and ongoing public transport improvements. The visit continued with a tour of key public facilities using the electric DRT/hail vehicle "Zapeljivec". At 11:20, the group joined the OPTI-UP electric van service operating on line 72 to Polica and returned at 11:40, with six passengers in total. The visit concluded with a return trip to Ljubljana using the integrated city–suburban bus line 3G. 

PA3	Paks	The preparatory activities focused on developing a methodology for the site visit to effectively monitor the pilot operation. A team defined four monitoring components: a personal journey on the new line, a check of stop accessibility and passenger information, an analysis of operational traffic data, and feedback from Line 5 staff. During the site visit, the test ride along the entire route ran punctually, with adequate audio announcements and all new stops already included in the service. Passenger information boards had been installed along the full line, featuring the updated Line 5 timetable. No delays or cancelled services were recorded up to 1:30 p.m., and operational staff confirmed that the service was functioning correctly and according to plan. 
PA4	Osijek	Preparatory activities focused on analysing publicly available information about the pilot, including official pages, social media content, online articles, and community feedback, which helped identify public perception and user-reported issues. A structured schedule was then developed, coordinating stakeholder meetings, timing the visit during peak hours, and planning a test ride on the pilot bus line.  During the site visit, participants first received a presentation of Osijek's Local Plan and its strategic link to the pilot line. This was followed by a discussion on the pilot line's objectives, route choices, service frequency, and early operational experience. Feedback was gathered from bus drivers to understand operational challenges, and turnover times and scheduling efficiency were assessed. The visit concluded with a ride on the pilot line to observe real-time service performance.

PA5	Pécs		The Pécs pilot site visit was announced by STRIA on 29 October 2025 during a WP2 session in České Budějovice, after which nearby partners TUW, GGP and Paksbusz confirmed their participation. The visit took place on 12 November 2025, organised together with Tüke Busz and attended by 13 participants. The programme began with a morning presentation on Pécs public transport at Tüke Busz headquarters, followed by a light lunch and a transfer to the end station of bus line 90. Participants then rode the 12:01 service across the full route before visiting the electric bus depot. During discussions, topics such as energy consumption, differences between Mercedes e-Citaro and BYD buses, national e-bus procurement and GTFS-based planning were addressed. Additional issues included staffing challenges and post-COVID impacts on ridership. The visit concluded with demonstrations of driver facilities, charging processes and maintenance procedures for the electric fleet.
PA6	Český Krumlov		Preparatory activities for the Český Krumlov pilot focused on organisational, technical and coordination tasks, carried out by a project team from VŠTE in cooperation with the city of Český Krumlov. Meetings with the city's Department of Transport ensured that the pilot aligned with local transport conditions, while technical preparations included collaboration with the transport operator, route verification, and readiness for deploying the electric bus. Communication efforts supported smooth internal coordination throughout the setup phase, enabling the pilot to operate fully during the site visit. During the visit, participants observed the electric bus in real service conditions through a guided ride on the pilot route, assessing comfort, accessibility, and boarding processes. Passenger information at stops was reviewed, and operational aspects were discussed with city representatives. Staff feedback was collected regarding daily operation, technical performance and challenges encountered. The visit concluded with a summary discussion highlighting initial findings and opportunities for optimizing the pilot solution.

2.3. Observations from the site visit

Below is a summary of the feedback and key insights received from participants during the six site visits.

Table 3: Key insights from the six pilot site visits

No.	OPTI-UP pilot action areas	Insights from the site-visit
PA1	Modena	- The system works well for core operations (booking, trip planning, tracking), but reporting tools need improvement. - The Agent interface is intuitive and enables fast and efficient bookings. - No operational issues were observed during peak call volumes. - New features increased user and driver autonomy while maintaining real-time monitoring and reducing direct communication. - Drivers provided positive feedback; the mobile app supports daily operations and navigation. - Main challenges relate to user cancellations and travel time estimates based on historical traffic data, which require further adjustments.
PA2	Grosuplje	- Line 72 operates fully according to the pilot plan, with no complaints reported. - Interviewed passengers were younger users of the service. - Passengers appreciated being able to request a ride less than two hours before departure. - They stated a preference for using a mobile app instead of the call centre. - Passengers learned about the service from leaflets distributed on buses. - They expressed a wish for a more flexible DRT system with more trips and adjustable departure times. - Some residents confuse the DRT line with other local services, highlighting the need for a clearer service name. - Call centre data enables the operator to shorten routes and reduce operational costs when appropriate. - Operators check for bookings in the opposite direction before shortening the journey. - The handheld ticket validator needs upgrades to support card payments and group tickets.
PA3	Paks	- The operations manager and traffic control officer reported no delays or cancellations on the new line until 1:30 pm on the first day. - Service reliability was confirmed as fully maintained throughout the monitored period. - The driver noted that passenger numbers were very low compared to other lines. - Low ridership is attributed to the line being newly introduced. - Passengers may need more time to become familiar with the new service. - The driver stated that the route is easy to operate. - No traffic obstacles or bottlenecks were encountered during operations. - Smooth driving conditions support reliable service performance. - Early observations suggest operational stability despite low initial demand. - Continued monitoring will help assess how ridership evolves over time.
PA4	Osijek	- Ridership on the pilot bus line is currently low, showing that the service has not yet reached its intended user uptake.

No.	OPTI-UP pilot action areas	Insights from the site-visit
		- Two important stops are missing from the route: near the new shopping mall and near Gospodarski centar Osijek. - The missing stops significantly reduce the attractiveness and usefulness of the line for daily passengers. - Some passengers boarded by mistake due to confusing signage, particularly the "Đakovština" display (another line also terminates at Đakovština terminus). - Clearer route information and improved signage are needed to prevent boarding by mistake. - Although the line was requested by the Retfala district, actual demand appears low. - Part of the route passes through non-residential areas (open fields), reducing potential ridership. - Tram network modernization creates complications: suspended tram services, required transfers, and temporary diversions. - Excessive temporary travel information may overwhelm passengers and deter public transport use. - Drivers confirmed operational schedules are respected but stressed the need for missing stops and better passenger information.
PA5	Pécs	- Participants of the study visit were particularly interested in passenger experiences and satisfaction with the new service. - Tüke Busz reported modest but gradually increasing ridership on pilot bus line No. 90. - New passengers have also begun using the newly introduced bus stops along the route. - User feedback indicates that the timetable does not fully match passengers' daily routines. - Passengers requested better alignment of departures with morning and afternoon peak hours. - Improved frequency during these peak periods could enhance usability and satisfaction. - Rising ridership suggests growing awareness and acceptance of the new service. - The need for timetable adjustment highlights the importance of user-centred scheduling. - Feedback collection appears to play a key role in refining the pilot. - Overall, the pilot line shows positive early trends but requires optimisation of service times.
PA6	Český Krumlov	- The electric bus was observed operating within the regular public transport system in Český Krumlov. - Pilot operations were stable and ran without major technical or operational issues. - The electric bus performed well in local conditions, including hilly terrain. - Passenger feedback was mostly positive, highlighting the quiet and smooth ride. - Some passengers mentioned the need for clearer information about the pilot service.

No.	OPTI-UP pilot action areas	Insights from the site-visit
		- Operational staff evaluated the vehicle positively, noting good handling and driving comfort. - Staff also emphasised the environmental benefits of using electric buses. - The pilot demonstrated that electric buses are technically suitable for small-city conditions. - Operational feasibility was confirmed through consistent performance during the pilot. - The results support further decision-making on the wider adoption of electric buses in public transport.

2.4. Comprehensive conclusions on site visits

Across all pilot locations, the site visits confirmed that the implemented solutions were operational, stable, and generally well-received by users and staff. For the DRT pilots in Modena and Grosuplje, the most important observations highlighted that the services functioned reliably and that users appreciated the convenience and responsiveness of the system. At the same time, both sites revealed challenges: Modena encountered issues with users not cancelling bookings, while in Grosuplje residents often confused the DRT line with other local on-demand services, signalling a need for clearer service identity and additional flexibility.

For the pilots focused on public transport network optimisation in Paks and Osijek, operations ran punctually and without disruptions. However, low ridership was a consistent issue, particularly in Osijek, where missing key stops and unclear signage caused confusion and reduced the line's attractiveness. External factors such as tram network reconstruction further complicated travel patterns and affected demand. Despite these challenges, basic operational stability was confirmed.

In the pilots showcasing alternative fuel technologies in Pécs and Český Krumlov, electric buses demonstrated strong technical feasibility. They performed reliably, even in demanding terrain, and received positive feedback for comfort and quiet operation. The experts in Pécs highlighted some differences between various types of electric buses in terms of user-friendliness and the availability of spare parts. Nonetheless, both pilots showed that electric fleets can be effectively integrated into small and medium-sized urban systems.

Overall, no major deviations from pilot plans were observed. The main challenges related to passenger awareness, early-stage ridership, information clarity, and specific technical constraints. They were all successfully contained.

3. Monitoring of pilot action performance

3.1. Plan of performance monitoring and evaluation

Monitoring of the performance of pilot action (PA) implementation was carried out through the observation of Key Performance Indicators (KPIs). KPIs are used to evaluate the achievement of key objectives through the applied pilot action solutions. The monitoring and evaluation plan defined the KPIs for each PA, the required input data, the tools, and methodologies for KPI calculation, and the evaluation process for assessing the results.

A set of KPIs was defined for each of the six pilot actions. The KPI lists were derived from a set of pre-defined indicators previously established in the Local Public Transport (PT) Optimisation Plans developed for each pilot action area (Modena, Grosuplje, Paks, Osijek, Pécs, and Český Krumlov).

Although the KPI sets are tailored to the specific objectives of each pilot action and monitoring goals, they are all aligned with the overall focus of the OPTI-UP project. In particular, they measure the level of public transport optimisation in terms of PT service accessibility (e.g. passenger ridership), operational optimisation (e.g. use of new PT mobility services and operational costs), and environmental impacts (e.g. greenhouse gas emissions) resulting from the introduction of electric-powered PT vehicles.

The following sub-sections provide a comprehensive report and comparative analysis of the KPIs applied across the six pilot actions, as well as an assessment of each pilot's performance based on these indicators. A detailed overview of KPI results for each pilot action (full reports) is provided in the listed sections of the appendix file ("D.2.2.1_OPTI-UP_COMPREHENSIVE EVALUATION REPORT_APPENDIX"):

- Appendix A: Pilot action in Modena,
- Appendix B: Pilot action in Grosuplje,
- Appendix C: Pilot action in Paks,
- Appendix D: Pilot action in Osijek,
- Appendix E: Pilot action in Pécs and
- Appendix F: Pilot action in Český Krumlov.

The full reports identify, list, and briefly describe the applied KPIs. The list also specifies the collected input data, data sources or providers, the methodology for KPI calculation, and the tools used for data processing and storage. Several input data sets may be required to calculate each KPI, as defined by the calculation methodology (description or mathematical formula). Where direct data sources (e.g. data providers) are not available, data acquisition devices such as measurement sensors and instruments are specified. For each KPI, target values are defined to establish thresholds for successful performance.

3.2. Overview of key performance indicators (KPIs) across PA

In this section, the key pilot assessment KPIs are identified, listed, and briefly described. The section also specifies the collected input data, data sources or providers, the methodology for KPI calculation, and the tools used for data processing and storage. Several input data sets may be required to calculate each KPI, as defined by the calculation methodology (description or mathematical formula). Where direct data sources (e.g. data providers) are not available, data acquisition devices such as measurement sensors and instruments are specified. For each KPI, target values are defined to establish thresholds for successful performance.

3.2.1. Modena

Table 4: Modena pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Average number of passengers per trip	number	1.2 passengers	Bookings registered	Weekly trend	App[†]	Spreadsheet
KPI_2	Total number of reservations	number	100 passengers	Bookings registered	Weekly trend	App	Spreadsheet
KPI_3	Number of no show	number	1 passenger	Bookings registered	Weekly trend	App	Spreadsheet
KPI_4	Total hours with users on board	h	50	Bookings registered	Weekly trend	App	Spreadsheet
KPI_5	Percentage of bookings via app	%	5% of total bookings	Booking registered	Weekly trend	App	Spreadsheet
KPI_6	Number of km travelled per week	km	1200	Booking registered	Weekly trend	App	Spreadsheet
KPI_7	Number of active users per week	number	22 passengers	Booking registered	Weekly trend	App	Spreadsheet

[†]App: Prontobus Modena e Provincia

3.2.2. Grosuplje

Table 5: Grosuplje pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Average number of registrations of DRT service per week	number of calls (per week)	15 (during the summer holidays), 23 (outside the summer holidays)	- Number of DRT service registrations received weekly (for line 72)	Weekly trend: [number of calls per week]	PTO (LPP)	Excel
KPI_2	Cost of energy consumption per passenger km	EUR/100 pkm (per week)	< 15	- Number of km travelled on line 72 - Average consumption of diesel [l/km] - price of diesel [EURO/l] - weekly cost on electric charging station for the electric van on line 72 - number of passengers (count of validations) on line 72	Weekly trend: [cost of fuel + cost of electricity]/ ([travelled kms]*[number of passengers])	PTO (LPP)	Excel
KPI_3	Average total eligible concession cost per km	EUR/km	< 2.27	- Number of bus km travelled on the line 72 - Number of van km travelled on the line 72	Weekly trend: ([bus km]*2.27+[van km]*1.30)/ ([bus km]+[van km])	PTO (LPP)	Excel

KPI_4	Share of trips with excessive capacity	% of runs (per week)	< 10	- Number of validations per run on line 72 - Type of vehicle (bus or van) per run on line 72	Weekly trend: ([number of van runs with 0 validations]+[number of bus runs with less than 8 passengers])/([number of van runs]+[number of bus runs])	PTO (LPP)	Excel
KPI_5	Share of trips with 0 validations among operated trips: Average number of empty runs per working day on line 72	% of runs (per week)	< 15	Number of validations per run on line 72	Weekly trend: [number of runs with 0 validations]/[number of all runs]	PTO (LPP)	Excel
KPI_6	Number of DRT trips without any passenger registrations per week	% of runs (per week)	> 50	for each DRT run mark if it was operated or not (line 72)	Weekly trend: [number of operated DRT runs]/[number of planned DRT runs]	PTO (LPP)	Excel
KPI_7	Occupancy of vehicles	% of total capacity	>40	- type of operated vehicle per run - capacity of operated vehicle per run - number of validations per run (line 72)	Weekly trend: weekly average across all runs([number of validations per run]/[capacity of operated vehicle per run])	PTO (LPP)	Excel
KPI_8	Number of complaints of passengers on PT operation per week	number of complaints/ week	< 10/week	- list of complaints on line 72 - reason of complaint	Weekly trend: total number of complaints on PT operation in a week	PTO (LPP)	Excel
KPI_9	Number of commendations of passengers to the PT operation per week	number of commendations/week	1/week	- list of commendations on line 72 - reason of commendation	Weekly trend: total number of commendations on PT operation in a week	PTO (LPP)	Excel
KPI_10	Amount of exhausted CO_2 per kilometre	kg/km	<30	- length of each run - km on line 72 - type of vehicle on each run	Weekly trend: [number of kms by BUS]*0.00025 tonnes/km	PTO (LPP)	Excel
KPI_11	CO_2 emissions per passenger km	kg/passenger	<0.6	- length of each run - km on line 72 - type of vehicle on each run - number of validations per each run	Weekly trend: [number of kms by BUS]*0.00025 tonnes/km/[number of passengers]	PTO (LPP)	Excel
KPI_12	Share of needed B driver's licenses for operation of DRT	% of licenses	>50	type of vehicle on each run on line 72	Weekly trend: [number of DRT runs per week operated by VAN]/[number of all DRT runs per week]	PTO (LPP)	Excel

3.2.3. Paks

Table 6: Paks pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Number of daily passengers; Average daily ridership on the 5th Line	passenger/day (on weekly base)	>= 19.2	-Number of passengers on Line 5	Weekly trend: weekly aggregated data divided by the number of days	PK	Excel
KPI_2	Single tickets sold; Weekly number of tickets sold on Line 5	Number of tickets sold (per week)	>= 50	Number of sold tickets on Line 5	Weekly trend: weekly aggregated data	PK	Excel
KPI_3	Percentage of delayed services; Weekly percentage of runs delayed by more than 5 minutes relative to total services	% of delayed runs (per week)	< 1%	Number of runs delayed more than 5 minutes on Line 5	Weekly trend: weekly aggregated data divided by the number of days	PK	Excel
KPI_4	Operational costs/passenger; Average operating cost per passenger on Line 5, based on weekly averages	HUF/passenger (average on weekly base)	< 3,600 Ft	Average of costs/km before starting line 5 Total number of passengers Total kilometres run	Weekly trend: weekly aggregated data divided by the number of days	PK	Excel
KPI_5	Total kilometres operated; Total weekly kilometres operated on Line 5	Km/(total on weekly base)	550.6 km	Total kilometres operated weekly on Line 5	Weekly trend: weekly aggregated data	PK	Excel

3.2.4. Osijek

Table 7: Osijek pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Weekly ridership on the observed line	passenger/week	750 passengers/week	Number of passengers registered	Weekly trend: [Number of registered passengers]	PTO (GPP)	Excel
KPI_2	Amount of CO2 per passenger [t]	Tonne/week	Unknown, will be defined in comparison	- Length of run - Type of vehicle on each run Number of validations per each run	Weekly trend: [number of kms by BUS]*0,00025 tonnes/km/[number of passengers]	PTO (GPP)	Excel

KPI_3	Number of km travelled per week	km/week	>2.900 km/week	Number of km travelled on line	Weekly trend: [km travelled x number of departures]	PTO (GPP)	Excel
KPI_4	Daily ridership on the observed line per each bus station	passenger /station/day	>0	Number of passengers registered per station	Daily trend: [Number of registered passengers per station per day]	PTO (GPP)	Excel
KPI_5	Average vehicle occupancy per day	% of daily capacity	> 30 %	Number of passengers per day	Daily trend: [Number of passengers per day/ Daily passenger capacity]	PTO (GPP)	Excel
KPI_6	Operational cost per passenger	EUR/passenger	<1,36 EUR/passenger	Weekly operational cost (fuel, drivers, cleaning, etc) Number of passengers	Weekly trend: [operational costs]/[number of passengers])	PTO (GPP)	Excel

3.2.5. Pécs

Table 8: Pécs pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Number of passengers per day	passenger/day	75 passengers/ day	Number of passengers	Daily trend	passenger counting equipment (PTO)	Excel
KPI_2	Number of passengers per one ride	passenger / one ride (per day)	15 passengers / ride	Number of passengers	Daily trend	passenger counting equipment (PTO)	Excel
KPI_3	Number of km travelled	km / day	56 km/day	Number of km travelled	Daily trend	statistic database (PTO)	Excel
KPI_4	Number of passengers at the new bus stops per day	passenger / bus stop (per day)	35 passenger / day	Number of passengers	Daily trend	passenger counting equipment (PTO)	Excel
KPI_5	Cost of energy consumption per km travelled per passenger on pilot line	EUR/pkm (per week)	0.24 EUR/pkm (with 5 workdays)	Number of km travelled Average consumption of electricity [kWh/km] price of electricity [EURO/kWh] number of passengers	Weekly trend	statistic database (PTO)	Excel

3.2.6. Český Krumlov

Table 9: Český Krumlov pilot action KPIs

KPI	Brief description	Unit	Target	Data list	Methodology	Data source	Data tool
KPI_1	Average number of passengers per electric vehicle per day: It measures the number of passengers per day.	Passengers/day	135	Daily Number of Passengers	Total Number of Passengers per Day / Statistical Survey	Carrier, Onboard Passenger Counters	Onboard Counters, Daily Reports
KPI_2	Average range per electric vehicle per charge	Km/charge	140	Number of Kilometres Driven per Charge, Number of Charges	Total Kilometres Driven Between Charges / Number of Charges	Records from the Vehicle Onboard System	Telematics, GPS System, Operational Logbook
KPI_3	Operational cost savings (fuel and maintenance) per vehicle/month	EURO, CZK/vehicle, EURO, CZK/month	Reduction in fuel and maintenance costs 5 %	Monthly Fuel and Maintenance Costs for Electric and Conventional Vehicles	Difference Between Average Monthly Costs of Electric and Conventional Vehicles	Carrier's Accounting, Technical Records of Vehicles	Cost Tables, Accounting Software
KPI_4	CO_2 emissions per km travelled per user	Grams/km/user	Reduction in CO_2 emissions 5 %	Amount of CO_2 Emissions, Number of Kilometres Driven, Number of Users	Total CO_2 Emissions / (Total Kilometres * Number of Users)	Calculations Based on Consumption and Emission Factors	Excel, Calculations According to Methodology
KPI_5	Share of kms travelled with zero emission vehicles in total kms travelled	%	Increase in the number of zero-emission Kilometres 5 %	Number of Kilometres Driven by Zero-Emission Vehicles, Total Number of Kilometres	(Number of Kilometres Driven by Zero-Emission Vehicles / Total Number of Kilometres) * 100	Records of Vehicles and Routes	Fleet Management Software, Excel

3.3. KPI evaluation of PA performance

3.3.1. Analysis of Key Performance Indicators

KPIs were calculated in accordance with the methodology described in the previous section. They were monitored on a weekly basis to identify any significant deviations in pilot action (PA) performance that required immediate attention to address or mitigate potential implementation challenges.

A statistical analysis of the KPIs was conducted to identify patterns and trends over the monitoring period in relation to baseline values, which represent the conditions prior to PA implementation. The analysis also assessed performance against the defined target values, which indicate the level of success of PA implementation.

The KPI analysis is based on the data collection plan, as well as the methodologies and tools for KPI calculation described in the previous section.

A detailed analysis is provided for each monitored KPI and for each PA. This analysis includes graphical representations of weekly KPI trends, including baseline values, target values, and trend lines, as well as a tabular assessment of PA performance for each KPI. The detailed KPI analyses are presented in the appendices stated in section 3.1.

A summary evaluation of each pilot action (PA) in terms of KPIs is provided based on the detailed analysis. The evaluation is presented in a summary table for each PA, offering an overview of overall KPI trends, progress toward the defined target values, deviation from baseline values, and a general assessment of PA success. Finally, conclusions regarding the achievement of PA objectives are provided.

A summary evaluation of the performance of all pilot actions in terms of key performance indicators (KPIs) is presented in the following subsections, which provide different analyses of the indicators. The KPI evaluation concludes with a comprehensive assessment of the performance of the OPTI-UP pilot actions.

3.3.1.1. Overview of applied KPIs and evaluation of achievements

This section summarises the key performance indicators applied across the pilot areas, including the justification for their selection and the evaluation of baselines and targets. It also provides an overall assessment of the achievement of individual pilot actions in terms of how successfully their targets were met. The results are presented in Table 10.

Actual performance indicated by the individual KPI is available in the report in the appendix (as given in 3.1) pertaining to each pilot area that provides a detailed graphical and tabular analysis of each KPI used in each pilot area, showing trend lines of KPIs through the period of observation, long-term expectation of KPI. target value and its achievement and overall KPI performance related to the set baseline.

Table 10: Overall achievement of the Pilot Actions based on KPI assessment

No.	OPTI-UP pilot action areas	Overall achievement of the Pilot Action (PA)
PA1	Modena	The KPIs applied in the pilot area focused on user activity, digital engagement, and operational efficiency, selected to capture uptake of the service and expected optimisation benefits. While baselines and targets were defined, some indicators, especially average passengers per ride, proved too limited to fully assess optimisation effects, and gaps in historical data further restricted comparisons.

No.	OPTI-UP pilot action areas	Overall achievement of the Pilot Action (PA)
		Despite these limitations, the pilot action was highly successful, demonstrated by significant growth in active users and strong adoption of app-based booking. System data also showed an increasing share of shared rides, stabilising around 30%, indicating partial achievement of optimisation goals and clear overall improvement of the service.
PA2	Grosuplje	The applied KPIs covered user adoption, operational efficiency, environmental impact, costs, staffing, and service experience. They were selected to assess key aspects of DRT performance and the effects of introducing electric vehicles, with baselines and targets defined for most indicators and descriptive analysis used for complaint- and commendation-based KPIs. Variations between holiday and non-holiday periods, as well as mixed vehicle use, influenced baseline interpretation and trend evaluation. Overall, the pilot action achieved strong results across most KPI categories. Environmental and cost indicators surpassed targets, vehicle utilisation improved markedly, and staffing flexibility increased well beyond expectations. User adoption remained stable or grew, and feedback showed low dissatisfaction and general acceptance of the DRT service. Although capacity was exceeded on a few afternoon trips, users mainly requested additional departures, indicating that the service is well-received and operationally promising.
PA3	Paks	The pilot action applied five KPIs covering passenger demand, ticket sales, service reliability, operational efficiency and service provision, selected to capture user uptake, operational performance, and financial viability. Baselines were set at zero, as the service was newly introduced, while targets were defined through modelling and operational planning. Monitoring showed clear positive trends in ridership and ticket sales, stable reliability with delays consistently below the 1% threshold, and predictable kilometres operated. Only operational cost per passenger remained above its target, despite improving as demand increased. Overall, the pilot action demonstrated strong progress toward its operational and service-related targets, with rising demand and stable service delivery confirming the line's functional success and user acceptance. Most targets were met or surpassed, except for cost efficiency, which remains the main challenge, as high initial costs and lower-than-expected early ridership resulted in financial underperformance. Thus, the pilot action can be assessed as operationally successful and well-received by users, but only partially successful from a financial sustainability perspective at this stage.
PA4	Osijek	The KPIs used in the pilot were designed to assess passenger uptake, operational performance, environmental impact, and data suitability. Passenger usage emerged as the most meaningful indicator of service relevance, while several other KPIs were limited by the short pilot duration and data availability. Baselines and targets were therefore defined pragmatically, acknowledging that some impacts, such as CO_2 reductions linked to modal shift, could not be reliably measured.

No.	OPTI-UP pilot action areas	Overall achievement of the Pilot Action (PA)
		Overall, the pilot action performed successfully, with a steady increase in passengers and clear evidence of user acceptance after the introductory phase. While not all KPIs showed measurable improvement, the pilot effectively demonstrated demand for the service and validated the concept. The presence of regular passengers, low dissatisfaction, and stable utilisation trends confirm the pilot's success and its potential for continued or expanded implementation.
PA5	Pécs	The KPIs selected for the pilot were designed to assess long-term expectations, performance against targets, and the clarity of target definitions. Their selection was justified by the need to monitor both baseline development and future service potential, with most KPIs found to have well-defined and appropriate targets. While long-term trends were positive across all indicators, performance relative to targets was more mixed, showing several negative trends and highlighting the need for continued monitoring and refinement of KPI definitions in future phases. The Pilot Action delivered largely positive results, with all KPIs showing rising long-term expectations and clear improvements in operational, economic, and environmental performance after the shift to electric buses. Although most indicators did not yet meet their target values, the overall KPI set effectively captured the pilot's core objectives, with zero-emission kilometres and CO_2 reduction emerging as the most meaningful measures. Data quality was sufficient for short-term monitoring, supported by operational records and vehicle systems, though future phases would benefit from more automated digital tools. In total, four KPIs were considered successful, confirming that the pilot broadly achieved its aims while highlighting areas where closer monitoring and targeted adjustments are still needed.
PA6	Český Krumlov	The KPIs were selected to capture key operational, cost related, and environmental effects of introducing electric buses, with baselines and targets set to reflect the pilot's core objectives. They adequately covered the main performance dimensions, with the share of kilometres travelled by zero emission vehicles emerging as the most representative indicator and environmental KPIs showing the clearest improvements. The Pilot Action performed well across key KPIs, showing operational, economic, and especially environmental improvements after introducing electric buses. Despite the short monitoring period, several indicators clearly improved compared to the previous situation, confirming that the main objectives were met. The selected KPIs were appropriate, with zero-emission mileage and CO_2 reduction most effectively reflecting the pilot's goals. Data sources were reliable for short-term assessment, and future use of automated digital systems would further strengthen monitoring. Overall, the KPI results show that the pilot delivered meaningful benefits and provides a strong basis for future development and possible replication.

3.3.1.2. Representation of the selected KPIs

This section provides a comparison of level of representativeness of the selected KPIs across the OPTI-UP pilot actions. The comparison focuses on the relevance and representativeness of each KPI for evaluation of the performance and outcomes of the implemented pilot solutions. The results are summarised in Table 11.

Table 1111: Representativeness of the selected KPIs per Pilot Action

No.	OPTI-UP pilot action areas	Representation of the selected KPIs
PA1	Modena	The most relevant and representative KPIs for evaluating the pilot actions are those linked to user engagement (active users and app-based bookings) since they directly show acceptance of the service and adoption of the digital tools. These indicators clearly reflect whether the pilot met its core goal of attracting and retaining users. In contrast, the operational KPIs on booking optimisation and driver utilisation are less precise, as they do not fully capture the complexity of service efficiency. While useful, they require further refinement to offer a clearer assessment of operational performance.
PA2	Grosuplje	The twelve KPIs offer a clear and balanced view of the pilot actions, covering technical dimensions such as environmental impact, operational efficiency, costs, service coverage, staffing, and schedule optimisation, alongside user adoption. Together, they form a relevant and representative set for evaluating overall performance. Their credibility is further supported by consistent weekly data collection using reliable and unbiased methods, ensuring a solid basis for assessment.
PA3	Paks	The selected KPIs are highly representative, as they collectively capture the core dimensions needed to evaluate the pilot actions: user uptake, revenue, operational reliability, cost efficiency, and service delivery. Passenger numbers act as the key indicator, directly reflecting whether the new service meets its primary goal of attracting users, while the remaining KPIs each add a distinct and necessary perspective. Together, they provide a complete and well-balanced picture of performance, with no redundant indicators. Adding a future KPI on passenger structure could further enhance representativeness, but the existing set already offers strong coverage of all essential aspects.
PA4	Osijek	The KPIs used in the pilot were generally relevant and reflected the performance of the new service, with passenger usage standing out as the most representative indicator of acceptance and demand. However, some KPIs were limited by the short monitoring period, which reduced their ability to show meaningful trends. Environmental indicators, such as CO_2 reduction, could not be reliably assessed due to missing data on modal shift. For future pilots, the KPI set could be improved by adding user-experience measures and simplifying indicators that cannot be accurately measured in short-term trials.
PA5	Pécs	The KPIs give a generally relevant view of the pilot's performance, with all indicators showing positive long-term expectations. Although most did not meet their target trends, target values were well defined, and data availability was adequate. Four KPIs were successful against both baseline and targets, indicating that the KPI set captures key performance aspects, while one KPI showed room

No.	OPTI-UP pilot action areas	Representation of the selected KPIs
		for improvement. Overall, the KPIs were appropriate but highlight the need for continued monitoring and adjustments.
PA6	Český Krumlov	The selected KPIs provide a clear and relevant view of the Pilot Action's performance, covering service operation, cost efficiency, and environmental impact. The share of zero-emission kilometres is the most representative indicator, directly reflecting the pilot's main objective, while CO_2-reduction KPIs further confirm environmental benefits. All applied KPIs are meaningful, with none considered redundant. For future evaluations, adding an energy-efficiency metric such as kWh per kilometre would further strengthen the assessment.

3.3.1.3. Availability and sustainability of data sources for KPIs

This section examines the availability and long-term sustainability of data sources for calculating the monitored KPIs across the pilot areas. Availability is essential to ensure that all required input data can be reliably retrieved to produce accurate and meaningful KPIs for the analysis. Sustainability, on the other hand, is crucial for enabling continuous long-term monitoring of KPIs, supporting ongoing observation of the public transport situation in the pilot areas, and facilitating timely responses through adjustments or the introduction of additional public transport measures. The results are summarised in Table 12.

Table 1212: Availability and sustainability of data sources for KPIs

No.	OPTI-UP pilot action areas	Availability of KPI data sources
PA1	Modena	Data availability for KPI calculation across the pilot areas is high, as the pilot relied on a subset of indicators already provided within the service provider's management application, ensuring easy access and flexibility to adjust or expand the KPI set in future monitoring. The data are readily accessible in the form of charts and tables and can be exported to Excel, enabling further analysis, cross-referencing, and deeper exploration of relationships between indicators. This high level of accessibility, combined with adaptable data structures, supports long-term sustainability and provides a solid foundation for continuous KPI monitoring and informed decision-making in public transport management.
PA2	Grosuplje	The availability of data for calculating KPIs across the pilot areas was ensured primarily through the transport operator, which provided weekly operational and passenger data, as well as registrations, commendations, and complaints. This information was collected and processed using Excel, a suitable approach for small datasets. However, long-term sustainability requires more automated and scalable solutions, such as web-based passenger registration systems, automatic ticket validation data, and database-to-database transfers via web services. Implementing consistent data verification and processing within custom-designed applications would support reliable, continuous KPI monitoring and timely adjustments to public transport services.
PA3	Paks	The data sources used for calculating the KPIs were readily available and sufficiently reliable, enabling consistent weekly monitoring across all pilot areas.

No.	OPTI-UP pilot action areas	Availability of KPI data sources
		Their simple structure and continuous accessibility ensured accurate calculation of demand-, revenue-, and operations-related indicators. However, long-term sustainability would benefit from reducing manual processing and moving toward automated data extraction from ticketing, dispatching, and vehicle-operation systems. Establishing a structured digital database or dashboard would support ongoing KPI monitoring, improve efficiency, and ensure that public transport performance can be tracked and adjusted sustainably over time.
PA4	Osijek	Data availability during the pilot was sufficient, as the necessary operational and passenger data were consistently accessible for producing meaningful KPIs. For long-term sustainability, however, more automated digital data-collection methods, such as mobile apps, onboard counters, or API-based integrations, would improve accuracy and reduce manual effort. Transitioning from spreadsheets to dedicated applications or integrated data platforms, supported by standardised data-collection protocols, would ensure reliable continuous KPI monitoring and timely adjustments to public transport services.
PA5	Pécs	The availability of data for calculating the monitored KPIs was sufficient to support the assessment, enabling reliable retrieval of the inputs needed for meaningful analysis. While long-term expectations for all KPIs were positive, mixed performance against target values highlights the need for sustained, high-quality data to guide ongoing monitoring. Clear and well-defined target values for most indicators support long-term sustainability, though one underperforming KPI indicates areas requiring improvement. Continued, consistent data collection is therefore essential to align future KPI outcomes with expectations, ensure timely adjustments in public transport measures, and maintain effective long-term performance tracking.
PA6	Český Krumlov	Data availability for KPI calculation was sufficient during the pilot, relying on operational records and onboard vehicle monitoring systems that ensured reliable and consistent input data. These sources supported accurate short-term KPI production, particularly for operational, cost-related, and environmental indicators. For long-term sustainability, automated digital data collection, such as telematics-based systems and standardized digital processing tools, is recommended to reduce manual work and minimize errors. Transitioning from spreadsheets to dedicated databases or web-based applications would further enhance reliability, support continuous monitoring, and enable timely adjustments to public transport services based on KPI trends.

3.3.1.4. List of essential KPIs

The list of essential KPIs provides for each pilot action a focused set of indicators that are mandatory for long-term monitoring of the performance of the implemented pilot measures. This shortlist supports key decisions regarding necessary adjustments or additional measures, and it enables effective monitoring when replicating the pilot solution in other areas. The remaining KPIs, used in the pilot action monitoring process, serve as supplementary indicators, offering additional contextual information to support performance evaluation. The shortlists are summarised in Table 13.

Table 13: Shortlists of KPIs across the pilot areas

No.	OPTI-UP pilot action areas	Representation of the selected KPIs	Target value
PA1	Modena	KPI_1, Average passengers per trip	1.2 passenger
		KPI_2, Total number of reservations on a weekly basis	100 passengers
		KPI_5, Percentage of bookings via app	50%
		KPI_7, Active users per week	22 passengers
PA2	Grosuplje	KPI_1, Average number of registrations of DRT service	23 registrations
		KPI_2, Cost of energy consumption per passenger km	15 EUR/100pkm
		KPI_6, Number of DRT trips without any passenger registrations	> 30%
		KPI_7, Occupancy of vehicles	> 40%
		KPI_11, CO_2 emissions per passenger km	< 0,6 kg/pkm
PA3	Paks	KPI_1, Number of daily passengers	19.2 passenger/day
		KPI_3, Percentage of delayed services	< 1%
		KPI_4, Operational costs/passenger	< 3.600 Ft/passenger
PA4	Osijek	KPI_1, Weekly ridership on the observed line	150
		KPI_4, Daily ridership on the observed line per each bus station	>0
		KPI_5, Average vehicle occupancy per day	30%
PA5	Pécs	KPI_3, Percentage of delayed services	75 passengers/day
		KPI_4, Operational costs/passenger	0.24 EUR/pkm
PA6	Český Krumlov	KPI_2, Average range per electric vehicle per charge	140 km
		KPI_3, Operational cost savings	5% reduction
		KPI_4, CO_2 emissions per km travelled per user	5% reduction

3.3.2. Comprehensive assessment of OPTI-UP pilot action success based on KPIs

3.3.2.1. Comparison of used KPIs

Table 14 provides an overview of all KPIs used across the OPTI-UP pilot actions. It highlights which KPIs were applied to monitor the performance of each pilot action, indicating the total number of KPIs used per pilot as well as identifying common indicators shared among pilots within the same thematic field and across the project. The KPIs are not always defined in a uniform way across the pilot actions and in some cases a single PA may use more than one KPI within the same category (similar KPIs).

The KPIs are primarily related to mobility, environmental, and financial/economic performance, while the social aspects of public transport are less covered.

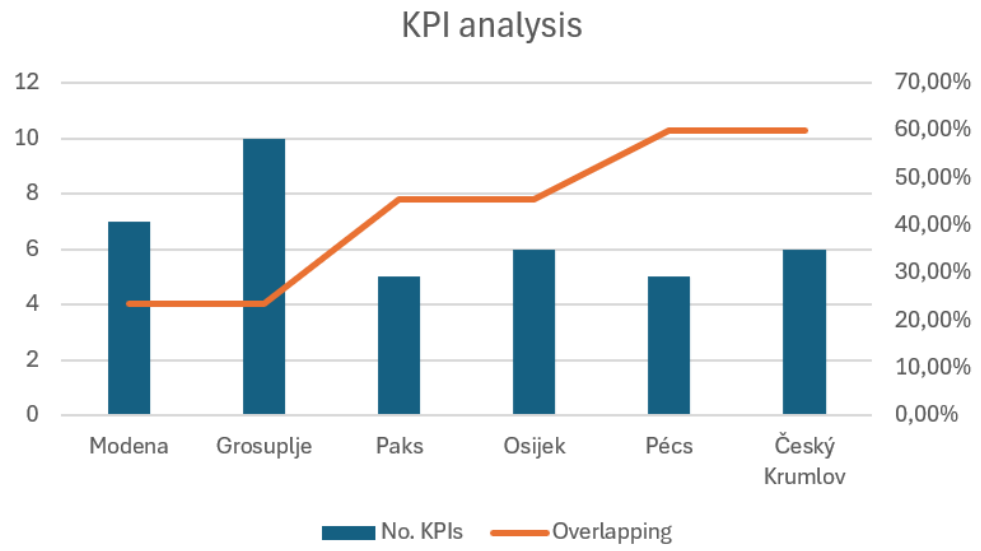
Table 14 shows that a total of 21 KPI categories were applied across the pilot actions. Among them, 9 KPIs fully or partially overlap (used in more than one PA). Within the thematic fields, the degree of full or partial overlap varies: for DRT monitoring, 4 of the 17 KPIs (23,5%) overlap; for public transport network optimisation, 5 of the 11 KPIs (45,5%) overlap; and for monitoring the implementation of alternative fuel technologies, 6 of the 10 KPIs (60.0%) fully or partially overlap.

It should be noted that the KPI labels used in the table are not harmonised across the OPTI-UP project but defined individually by each pilot action. Consequently, KPI_1 in one pilot action does not necessarily correspond to KPI_1 in another, as the definitions differ.

Table 14: Overview of application of KPIs across OPTI-UP pilot actions

KPI description	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Total number of reservations / registrations	KPI_2	KPI_1	-	-	-	-
Number of no-shows	KPI_3		-	-	-	-
Total hours with users on board	KPI_4	-	-	-	-	-
Number of active users/sold tickets	KPI_7	-	KPI_2	-	-	-
Number of km operated	KPI_6	KPI_3	KPI_5	KPI_3	KPI_3	KPI_5
Ridership (per trip/daily / weekly / monthly / station)	KPI_1		KPI_1	KPI_1, KPI_4	KPI_1, KPI_2, KPI_4	KPI_1
Energy cost per passenger-km	-	KPI_2	-	KPI_6	KPI_5	-
Operational cost per km / passenger	-	KPI_3	KPI_4	-	-	-
Excess capacity / trips with low occupancy	-	KPI_4	-	-	-	-
Empty runs (0 validations)	-	KPI_5	-	-	-	-
Share of not-operated journeys	-	KPI_6	-	-	-	-
Vehicle occupancy	-	KPI_7	-	KPI_5	-	-
Passenger complaints	-	KPI_8	-	-	-	-
Passenger commendations	-	KPI_9	-	-	-	-
CO_2 emissions (per km or per passenger)	-	KPI_10, KPI_11		KPI_2	-	KPI_4
Share of zero-emission km	-	-	-	-	-	KPI_5
Driver licence requirements (B licence share)	-	KPI_12	-	-	-	-
Passengers per electric vehicle per day	-	-	-	-	-	KPI_1
Electric vehicle range per charge	-	-	-	-	-	KPI_2
Operational cost savings (fuel & maintenance)	-	-	-	-	-	KPI_3
Amount of delayed services	-	-	KPI_3	-	-	-

Figure 2: Comparison of number of used KPIs and level of overlapping across PAs



3.3.2.2. Overview of behaviour of monitored KPIs

The aggregated statistics provide a comparative analysis of KPIs that were employed for monitoring of PA performance of pilot actions. For each pilot action 5 characteristics have been compared:

- Trend of long-term expectation of the PA
- Trend of KPI in relation to set target
- impact on the baseline situation
- Definition of target value
- Successfulness of PA in relation to the baseline and target value.

Since a different number of quantitatively measured KPIs were employed for different pilot areas the analysis has been provided of the relative values. The number of the applied KPIs varies among the pilot areas from 5 to 10[1].

Table 15: Comparison analysis of KPIs behaviour across pilot areas

No	Evaluated characteristics	Metrics	Observed KPIs in pilot action areas					
			Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Number of evaluated KPIs on the pilot area			7	10	5	6	5	6
1.	Trend of long-term expectation of the PA	Increasing	85.7%	50.0%	40,00%	50.0%	100.0%	40.0%
		Decreasing	0.0%	40.0%	20,00%	33.3%	0.0%	0.0%
		Stable	14.3%	10.0%	40,00%	16.7%	0.0%	60.0%
2.	Trend of KPI in relation to set target	Positive	57.1%	100.0%	40,00%	50.0%	0.0%	80.0%
		Negative	0.0%	0.0%	20,00%	33.3%	80.0%	0.0%
		Neutral	28.6%	0.0%	40,00%	16.7%	20.0%	0.0%
3.		Improvement	71.4%	100.0%	20,00%	50.0%	NA†	100.0%

[1] In Grosuplje, 12 KPIs were monitored, 10 quantitative and 2 qualitative. The 2 qualitative KPIs were not analysed and are therefore not included in the comparative analysis.

	Impact on the baseline situation	Insignificant change	28.6%	0.0%	60,00%	50.0%	NA	0.0%
		Worsening	0.0%	0.0%	20,00%	0.0%	NA	0.0%
4.	Definition of target value	Very good	0.0%	30.0%	20,00%	33.3%	80.0%	80.0%
		Good	57.1%	40.0%	60,00%	16.7%	20.0%	20.0%
		Unsuitable	28.6%	30.0%	20,00%	50.0%	0.0%	0.0%
5.	Successfulness of PA in relation to the baseline and target value	Successful	71.4%	100.0%	80,00%	83.3%	80.0%	100.0%
		Unsuccessful	14.3%	0.0%	20,00%	16.7%	20.0%	0.0%

† Baseline does not exist for a new service

Across the pilot areas, the evaluated KPIs reveal notable differences in performance patterns and progress toward target values. Modena, Pécs, Grosuplje, and Osijek show pronounced changes in indicator values, whereas Paks and Český Krumlov display a higher share of stable indicators.

In terms of meeting targets, Grosuplje and Český Krumlov perform the best, demonstrating consistently positive or mostly positive trends, while Pécs shows predominantly high deviation from the target.

Regarding impact on the baseline, Grosuplje and Český Krumlov achieve the most substantial improvements, whereas Paks does not record large changes.

The quality of target definition varies considerably: Pécs and Český Krumlov achieve the highest scores, while Grosuplje and Osijek face challenges due to some unsuitable[2] or insufficiently defined targets.

Overall, the highest success of pilot actions, supported by KPI evidence, is observed in Grosuplje and Český Krumlov, followed closely by Osijek, Paks, and Pécs, while Modena also performs well but exhibits a slightly higher share of unsuccessful KPIs.

3.3.2.3. Overall conclusion on performance of pilot actions

The OPTI-UP pilots across Modena, Grosuplje, Osijek, Paks, Pécs and Český Krumlov show a clear shift toward more efficient, low-emission and user-focused PT services. Despite differences in thematic fields, most pilot actions achieved meaningful improvements, particularly in operational efficiency, service uptake, and emissions reduction, though challenges remained particularly in financial sustainability.

Most pilots reported long-term trends of KPI changes, signalling growing improvement of PA performance. Modena and Pécs showed especially strong changes, while Paks and Český Krumlov on the other hand exhibited more modest but still stable improvements. In achieving the KPI-targets, Grosuplje emerged as the strongest performer, followed by Český Krumlov and Modena. Pécs struggled some underscored achievement, while Osijek and Paks achieved the targets moderately well.

In terms of moving the baseline state, Český Krumlov, Grosuplje and Modena demonstrated very good improvement. Osijek slightly moderate and Paks only limited progress. Pécs could not be fully assessed due to missing baseline data.

Overall, all pilots achieved strong performance against combined baseline and target expectations, with Grosuplje and Český Krumlov delivering the most transformative results, marked by optimized vehicle use, reduced empty trips, higher occupancy, and notable emission reductions. Modena excelled in digital uptake, Osijek showed steady but inconsistent progress, Pécs revealed strong potential that requires better-targets definition, and Paks demonstrated demand but struggled financially.

Finally, the pilot solutions validate the potential of demand-responsive transport solutions, efficiency of digital supported and strong impact on reducing on polluting gas emissions in transport. They confirm their relevance for future sustainable mobility strategies with good financial planning and refinement of targets.

[2] In Grosuplje two distinctive targets need to be defined, one for school period and another for summer season,

4. Users' acceptance

Feedback from users of public transport services, whether newly introduced or modifications of existing PT services, is a crucial element in assessing pilot action (PA) performance. User acceptance of the PT services is particularly important, as they are the primary beneficiaries of the PT services.

A user survey was conducted in all PA areas among current and potential users of the piloted PT services to evaluate their experience and satisfaction with the implemented services. The survey was based on structured questionnaires and carried out during the final phase of PA implementation, ensuring that users had sufficient experience with the new services to provide meaningful feedback.

The survey collected both general and service-specific information on user satisfaction. General questions were consistent across all PA areas, enabling meaningful comparisons, while specific questions provided additional insights tailored to the objectives of each pilot action.

All surveys were conducted in the local language of each PA area and completed no later than November 2025.

The survey implementation methods, such as online publication, distribution of leaflets on vehicles, or personal interviews, varied across the PA areas. The number of reached respondents also differed, ranging from 9 in Český Krumlov to 64 in Grosuplje. For this reason, responses to the general survey are compared using relative values (%).

The following subsections present an overview of user feedback on general questions to the piloted services, including a comparison of responses across PA areas. The general analysis is followed by a review of specific comments identified for each PA area.

Detailed data on users' feedback for each PA area are provided in the listed sections of the appendix file ("D.2.2.1_OPTI-UP_COMPREHENSIVE EVALUATION REPORT_APPENDIX"):

- Appendix A: Pilot action in Modena,
- Appendix B: Pilot action in Grosuplje,
- Appendix C: Pilot action in Paks,
- Appendix D: Pilot action in Osijek,
- Appendix E: Pilot action in Pécs and
- Appendix F: Pilot action in Český Krumlov.

User satisfaction with the implemented pilot action (PA) services is assessed through six general questions administered across all OPTI-UP pilot areas (Section 4.1), as well as through pilot-area-specific questions, with three to five tailored questions defined for each study area (Section 4.2). The following subsections present an analysis of the collected feedback, accompanied by tables and explanatory interpretations of the results.

4.1. Feedback to general questions

4.1.1. Provision of information to users about the pilot action

Table 16: Reporting on how users were informed about the pilot action

Information channels	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Other	38.5%	7.8%	0.0%	14.3%	8.5%	0.0%
Other people	7.7%	35.9%	8.0%	19.1%	76.3%	10.0%
In the vehicle	0%	25.0%	0.0%	9.5%	3.4%	10.0%
PTO channels	46.1%	6.3%	72.0%	57.1%	6.8%	0.0%
Municipality channels	7.7%	25.0%	20.0%	0.0%	5%	80.0%

The six OPTI-UP pilots use different information-channels to communicate with users. Modena, Paks, and Osijek rely mainly on official communication via transport operators. In Grosuplje and especially Pécs the information spread mostly among users themselves. In Český Krumlov local authorities dominant announced a new service.

4.1.2. Satisfaction with the implemented pilot action service

Table 17: Satisfaction with the new PT service

User satisfaction	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Very unsatisfied	7.7%	61.8%	0.0%	19.1%	23.7%	0%
Unsatisfied	0%	21.8%	3.7%	14.3%	10.2%	0%
Indifferent	30.8%	3.6%	37.0%	14.3%	10.2%	0%
Satisfied	38.5%	5.5%	44.4%	42.9%	22%	11%
Very satisfied	23.1%	7.3%	14.8%	9.5%	33.9%	89%

Users in Český Krumlov were satisfied, nearly 90%. In Modena and Paks most users were satisfied and almost no one very dissatisfied. In Pécs and Osijek the reactions were mixed. In Grosuplje the users of were highly dissatisfied as the pilot solution reduced accessibility of the existing public service.

4.1.3. Contribution of the pilot service to environmentally friendly public transport

Table 18: Assessment of the environmental benefits of the new PT service

Environmental assessment	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Yes	84.6%	32.7%	87.5%	61.9%	64.4%	100%
No	15.4%	67.3%	12.5%	38.1%	35.6%	0%

Users widely perceived strong environmental benefits in Český Krumlov, Paks and Modena. Osijek and Pécs showed moderately positive views. In sharp contrast, Grosuplje users mostly perceived no environmental benefit. This may reflect users' dissatisfaction with reduced public transport accessibility, which overshadowed the communicated environmental benefits.

4.1.4. Impact of the introduction of the pilot service on public transport use

Table 19: Impact of the new PT service on public transport use

Impact on PT use	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
No impact	53.8%	12.7%	28%	57.1%	64.4%	56%
More frequent use	30.8%	7.3%	64%	33.3%	23.7%	22%
Less frequent use	0.0%	69.1%	0%	0.0%	1.7%	11%
New PT user	15.4%	0.0%	8%	4.8%	5.1%	0%
I do not use PT	0.0%	10.9%	0%	4.8%	5.1%	11%

The impact on public transport use varied substantially. In Paks and Modena many users ride more frequently, and new passengers join the system. Osijek, Pécs and Český Krumlov saw mostly no change, with only modest increases in use. Only in Grosuplje most users reported riding public transport less often, which again implies that poorly perceived changes can have negative impact on PT service use.

4.1.5. Intention to continue using the pilot action service

Table 20: Intention of users to continue using the pilot action service

Intention to continue using	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Yes	33.3%	9.1%	63.6%	14.3%	22%	56%
Yes, with improvements	28.6%	25.5%	22.7%	47.6%	32.2%	22%
Yes, only if necessary	14.3%	12.7%	13.6%	28.6%	13.6%	0%
No	23.8%	52.7%	0.0%	9.6%	32.2%	22%

Users' willingness to continue using the pilot services also varies greatly across PA areas. In Paks and Český Krumlov most users intend to continue use, often unconditionally. In Modena and Pécs many users would continue only if certain improvements were made. Also in Osijek, half of the users would continue the use only with service upgrades. Grosuplje stands out negatively, with a majority unwilling to keep using the service without major changes.

4.1.6. Recommendation of the pilot action service to non-users

Table 21: User willingness to recommend the pilot action service

Recommendation	Modena	Grosuplje	Paks	Osijek	Pécs	Český Krumlov
Yes	84.6%	34.5%	94.4%	57.1%	66.1%	78%
No	15.4%	65.5%	5.6%	42.9%	33.9%	22%

Share of the users that would recommend the service to the non-users is the highest in Paks, Modena, and Český Krumlov. Moderate support is seen in Pécs and Osijek with mixed user experiences. In Grosuplje most users are unwilling to recommend the service. Overall, recommendation levels closely mirror user satisfaction.

4.2. Feedback to specific questions

4.2.1. Modena

User feedback from Modena indicates strong approval of the new digital features introduced in the service. Most respondents preferred the smartphone-based booking system, and the simplified reservation process was identified as the most valued improvement. Real-time features, such as driver arrival notifications and easy trip modifications, were also positively received. App feedback was similarly favourable, with an

average rating of 4.2 and predominantly positive comments. Overall, users in Modena show high satisfaction with the new digital tools and service enhancements.

4.2.2. Grosuplje

User feedback from Grosuplje reveals generally low satisfaction with the new DRT service. While many users did not report specific issues, some noted problems such as limited vehicle space and call-centre responsiveness. The most common improvement requests were additional trips and better timetable harmonisation, reflecting concerns about service frequency and coordination. Overall attitudes were largely negative, particularly on line 72, where users criticised the lack of weekend and holiday service and expressed a preference for reinstating regular bus lines or increasing departures. Users also stressed the need for better schedule integration and a more flexible system that does not require advance booking.

4.2.3. Paks

Users in Paks reported few difficulties, with one-third noting no issues. The main concerns were a timetable not well adapted to passenger needs, inadequate bus stops, and poor coordination with other PT services. Improvement suggestions are focused on more frequent trips, additional stops, and better alignment with local and intercity buses, while a few users asked for a better information system. General feedback suggests positive acceptance, with key upgrades, especially to frequency, placement, and number of stops on the line and timetable coordination.

4.2.4. Osijek

User feedback from Osijek was generally positive, with the pilot line appreciated for connecting residential areas to key destinations. The main issues raised concerned bus stops and timetable coordination, and users most often suggested adding more stops and improving schedule harmonisation. Although citywide infrastructure works negatively affected satisfaction and ridership, respondents still valued the service and indicated that performance would likely improve once stop coverage and timetable alignment are addressed.

4.2.5. Pécs

User feedback from Pécs shows mixed satisfaction with bus line 90: users were divided over the route and schedule, with negative ratings slightly higher than positive ones. In contrast, the electric buses were very well received, earning strong approval from most respondents. Users most often requested route adjustments, better timetable coordination, weekend service, and more frequent buses. Overall, while the service attracted some new users and was viewed positively in terms of environmental impact, improvements to routing and scheduling are needed to raise overall satisfaction.

4.2.6. Český Krumlov

User feedback from Český Krumlov was largely positive, with most users reporting no problems during electric bus rides and only a few noting minor issues. The most common improvement requests were higher service frequency and a mobile app with real-time information, followed by better timetable coordination and clearer stop information. Additional comments suggested expanding capacity, improving information panels, and adding features like stop announcements or ticket machines. Overall, users found the service reliable but see opportunities to improve information clarity and service availability.

4.3. Overall assessment of users' satisfaction

The overall assessment of user satisfaction can be summarised in key conclusions:

- **Český Krumlov** shows exceptionally high satisfaction, with nearly all users very satisfied, strongly recognising environmental benefits and recommending continued use.
- **Paks** and **Modena** have many satisfied users and report increased PT use, strong willingness to recommend, and only minor operational issues (supported by effective PTO-led communication).
- **Osijek** and **Pécs** demonstrate mixed satisfaction of users, although appreciate certain improvements (e-buses in Pécs or new connections in Osijek) but expressed concerns about stop placement, frequency, and timetable coordination.
- **Grosuplje** stands out with very low user satisfaction, largely due to reduced accessibility caused by recategorizing a regular bus line into a DRT service. As a result, users perceive little environmental benefit, report high dissatisfaction, reduce their PT use, and show a strong unwillingness to continue using or recommending the new service.
- Across all pilots, satisfaction closely correlates with service quality, visibility of improvements, environmental contribution, communication effectiveness, and alignment of timetables and layout of the PT lines with user needs.

5. Stakeholders' feedback and recommendations for scaling-up and transferability

The key outcomes of the OPTI-UP pilot actions, together with the conditions and recommendations for scaling up the existing pilot solutions and their transferability to other municipalities and regions facing similar public transport (PT) challenges, were discussed with key stakeholders involved in each pilot action. Six dedicated stakeholder meetings, one for each pilot action (PA) area, were organised by the responsible partners.

The PA monitoring results were presented at these meetings and discussed with stakeholders to gather feedback on the operational and financial implications of sustaining the pilot action services. Stakeholders also provided recommendations on opportunities for scaling up the pilot solutions and replicating them in other municipalities and regions.

The stakeholder groups encompassed a broad range of competencies and levels of authority, including institutional, financial, and operational expertise. This ensured that all relevant perspectives were represented, from decision-makers to those, responsible for providing the institutional, financial, and operational resources, necessary for delivering the pilot public transport services.

The following subsections present the implications and recommendations related to operational and financial conditions, as well as the potential for scaling up and replicating each pilot solution and in a comprehensive way for each thematic solution composed of two pilot solutions.

The following subsections present the implications and recommendations related to operational and financial conditions, as well as the potential for scaling up and replicating each pilot solution and provide a comprehensive overview for the three thematic solutions (1. demand-responsive transport (DRT); 2. public transport network optimization; 3. alternative fuel technologies), each composed of two pilot solutions.

Detailed reports of the stakeholder meeting discussions for each PA area are provided in the listed sections of the appendix file ("D.2.2.1_OPTI-UP_COMPREHENSIVE EVALUATION REPORT_APPENDIX"):

- Appendix A: Pilot action in Modena,
- Appendix B: Pilot action in Grosuplje,
- Appendix C: Pilot action in Paks,
- Appendix D: Pilot action in Osijek,
- Appendix E: Pilot action in Pécs and
- Appendix F: Pilot action in Český Krumlov.

5.1. SOLUTION 1: The demand-responsive transport (DRT)

5.1.1. Key outcomes and upscaling recommendations for Modena

5.1.1.1. Using transport modelling to plan public transport measures

Modena's experience shows that transport and LUTI modelling is useful mainly for exploring and comparing scenarios, not for making final decisions. The quality and regular updating of input data are essential for achieving reliable modelling results. Current models still overfocus on private transport and oversimplify public-transport and DRT behaviour, which limits accuracy. The Visum DRT module supports operational evaluation but cannot capture demand responses.

5.1.1.2. Key operational conclusions and recommendations for up-scaling and replication

Up-scaling of the DRT solution in Modena mainly requires software upgrades rather than new resources or major budget changes. Replication depends on strong cooperation between the municipality and the operator. A key prerequisite is effective user communication, also with long-term riders, since the schedules have been optimised. The modular software allows easy expansion to additional DRT services. Given its clear social value and minimal extra costs, Modena decided to continue the service.

5.1.1.3. Key financial conclusions and recommendations for up-scaling and replication

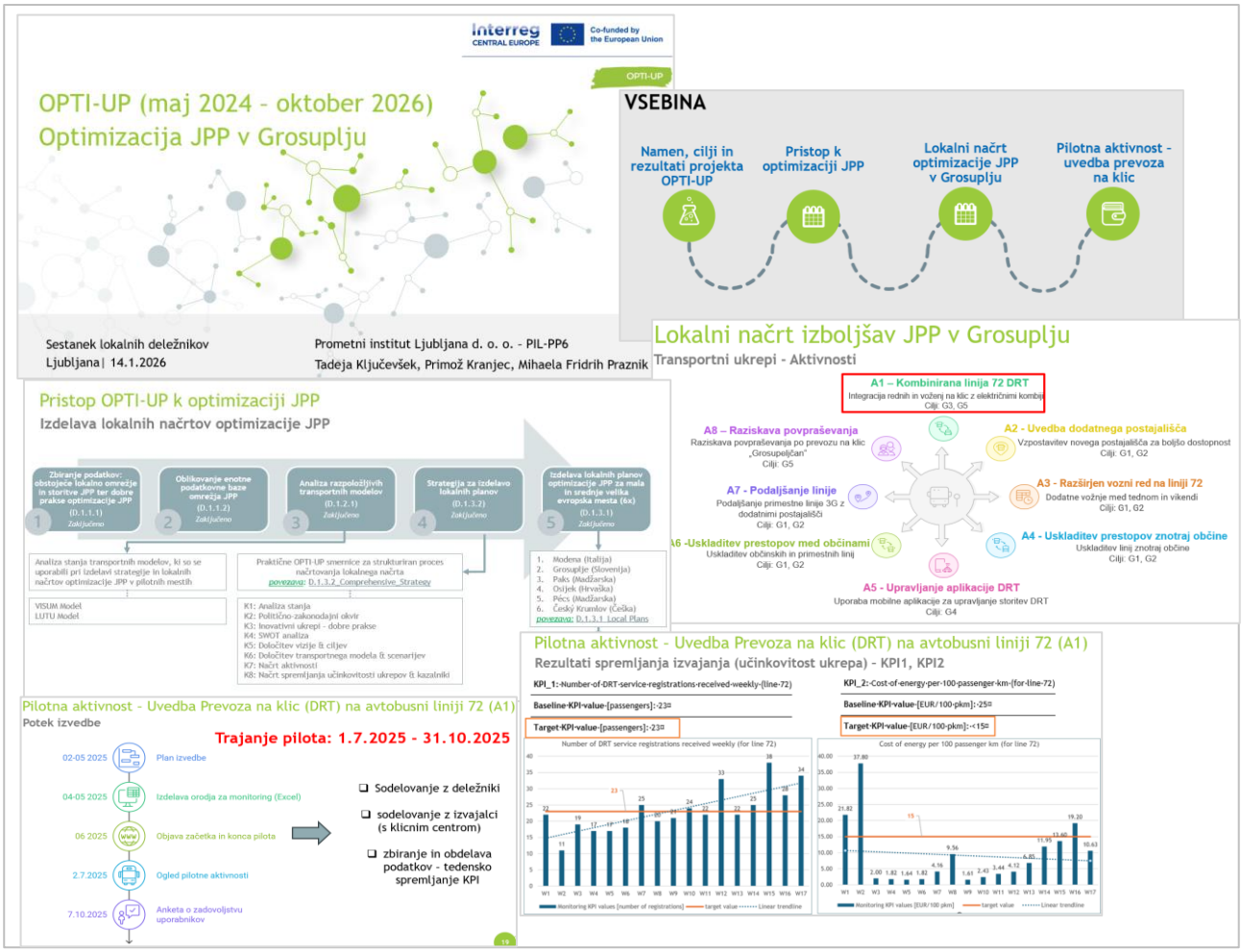
Implementing the pilot involved only a single one-off investment for developing the user application and management software. The operating costs remain low and can rise with expansion of DRT service, which are financially manageable, requiring only new stops, without additional staff or vehicles. The service is structurally non-profitable and relies on continued municipal and regional funding. Expansion to new areas would be significantly more costly, as it would require new vehicles and personnel, which may require national and regional funds for low-demand areas and digital mobility tools, which are increasingly available.

5.1.1.4. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The pilot solution can be scaled to other low-demand areas thanks to its flexible, app-based design. Successful expansion depends mainly on close coordination between the municipality and operator and clear communication to users. Optimised solution should provide integration of DRT as a feeder into a broader line. Key obstacles include limited funding, driver shortages, and constraints of existing public-service contracts. Replication will benefit from political support, standardised methods for identifying user needs and adaptable EU-level digital tools.

5.1.2. Key outcomes and upscaling recommendations for Grosuplje

Figure 3: Slides from the presentation of Grosuplje pilot action results



5.1.2.1. Using transport modelling to plan public transport measures

The pilot action shows that transport modelling can effectively support local public transport (PT) planning. Scenario simulations helped assess the effects of service adjustments, route changes, and frequency modifications, offering useful comparisons of demand, cost, and emission impacts. It did not serve as a standalone decision-making tool.

After adaptation, the model identified low-demand services, highlighted optimisation options and provided a solid basis for testing improvements. In combination with other operational data and stakeholder input, modelling proved a practical tool for supporting local PT planning.

5.1.2.2. Key operational conclusions and recommendations for up-scaling and replication

The Grosuplje pilot showed that demand-responsive transport can improve low-demand public transport services when supported by thorough analysis, coordinated planning and adequate funding. Replication requires identifying low-occupancy routes, defining operational rules, and ensuring strong cooperation between the public transport authority, municipalities, operators, and booking-system providers. The main

challenges lie in aligning institutional and contractual frameworks and securing stable financing. Although the pilot delivered operational and environmental benefits, it was discontinued due to financial and regulatory constraints, as the ministry, after the conclusion of the pilot action, no longer wished to finance scheduled trips that were not operated (not registered DRT trips), which would have reduced the transport operator's long-term contracted revenues. With adapted contractual conditions and integration across neighbouring municipalities, the model remains feasible for up-scaling and replication.

5.1.2.3. Key financial conclusions and recommendations for up-scaling and replication

The financial assessment of the Grosuplje pilot shows that sustaining and replicating DRT services relies on managing operational costs for vehicles, drivers, and trip coordination, while securing stable, funding. The pilot was financed through DUJPP public transport budget in supported of national and EU mechanisms such as the Social Climate Fund and Eko Fund vehicle subsidies. Additional municipality co-financing remained unchanged. Further funding potential lies in reallocating existing transport budgets, cost-sharing among benefitting municipalities and operational optimisation, particularly by replacing large buses with smaller vehicles on low-demand routes and not operating empty-trips. Expanding the service within or across municipalities can reduce average costs through better fleet utilisation of the same PTO, more flexible personnel deployment, and shared booking systems. For wider replication, the Social Climate Plan 2026-2032, DUJPP resources and municipal contributions provide a solid basis for long-term financial sustainability.

5.1.2.4. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The Grosuplje pilot shows strong potential for scaling up DRT services in transport-poor and rural areas across Slovenia. Replication is feasible where low-frequency or missing public transport can be replaced with flexible, smaller vehicles. Expansion across neighbouring municipalities would improve fleet use, driver distribution, and cost efficiency, especially when paired with alternative-fuel vehicles supported by national subsidies. Sustainable up-scaling requires stable financing through the Social Climate Plan and flexible reallocation of existing PT budgets. Although legislation already permits DRT, current concession contracts limit operational flexibility: concession contracts need to be adjusted so that the PTO's contracted revenues are not reduced but rather redirected to other services. A unified national booking and dispatching platform is recommended to support integration, standardisation, and potential cross-border compatibility. With coordinated governance among municipalities, flexible contracting, and digital support, the Grosuplje model is well-positioned for broader implementation.

5.1.3. Common conclusions and recommendations for scaling up DRT pilot solution

Across both pilot experiences, demand-responsive transport (DRT) proved an effective approach for improving mobility in low-demand areas, provided it is supported by coordinated planning, flexible operational frameworks, and stable financing. Transport modelling can guide identification of low-occupancy services suitable for conversion to DRT as a complement to local knowledge and stakeholder input.

Successful upscaling depends on close cooperation between authorities, operators, and digital platform providers, supported by clear user communication and adaptable contractual arrangements that enable flexible service deployment without reducing operators contracted revenues.

Financially, gaining better efficiency through DRT services, requires modest investment when integrated into existing networks, while expansion across neighbouring territories can additionally improve efficiency through shared fleets, staff and booking systems.

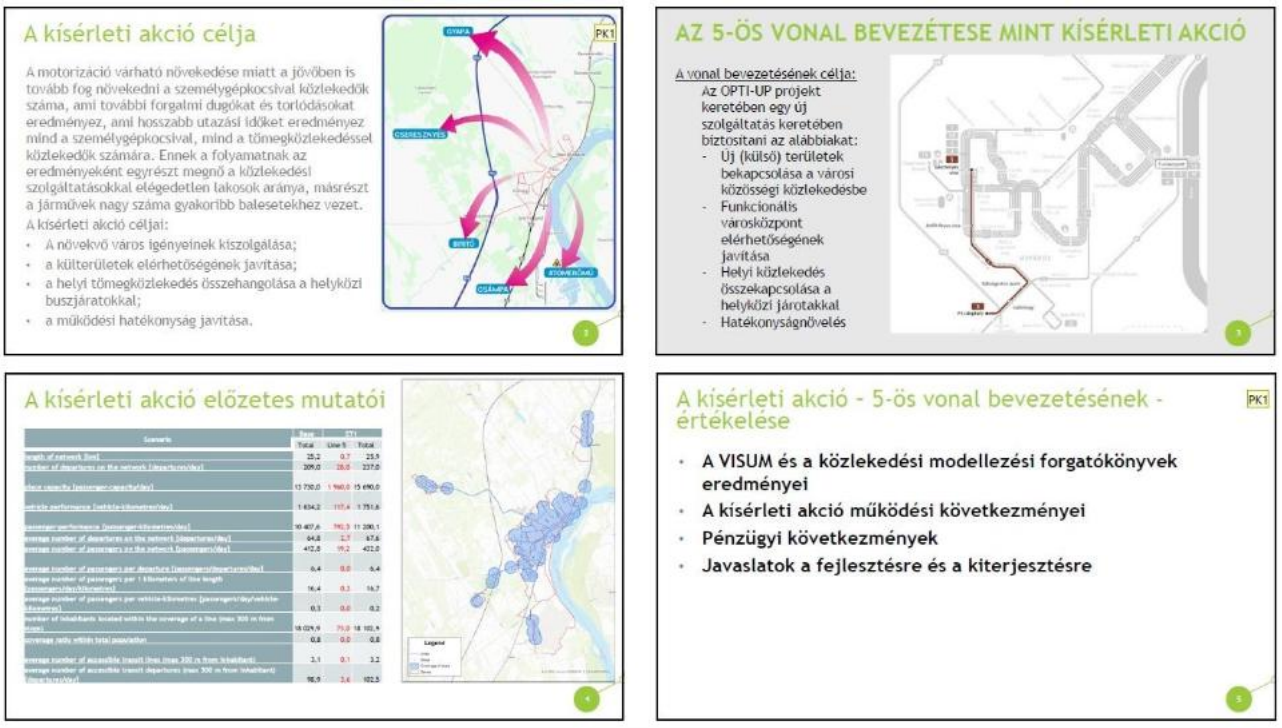
Long-term sustainability is strengthened by reallocating savings from unused fixed services, leveraging national or regional funding programmes and adopting unified digital tools (for DRT registration and operation) that support wider interoperability.

Overall, both pilots highlight that with appropriate governance, contractual flexibility and strategic funding, DRT can be scaled and replicated as a cost-efficient, environmentally supporting and socially valuable solution for transport-deprived areas.

5.2. SOLUTION 2: Public transport network optimization

5.2.1. Key outcomes and upscaling recommendations for Paks

Figure 4: Slides from the presentation of Paks pilot action results



5.2.1.1. Using transport modelling to plan public transport measures

The Paks pilot showed that transport modelling is a useful tool for evaluating and planning public transport improvements, enabling comparison of alternatives and forecasting demand and network impacts. Its reliability depends on accurate data, realistic assumptions, and continuous calibration to local conditions. In Paks, modelling supported approval of a new line and aligned with efforts to strengthen public transport. However, model results must be validated through field observations, user feedback, and stakeholder consultation. Regular data updates are essential as travel habits and service areas evolve. Overall, modelling is effective when combined with real-world insights and professional oversight.

5.2.1.2. Key operational conclusions and recommendations for up-scaling and replication

The Paks pilot shows that successful replication requires detailed documentation, feasibility assessments and coordinated planning across transport authorities, operators, municipalities, and infrastructure managers. The most time-intensive steps are securing funding, procurement and permitting, supported by wide stakeholder engagement to ensure PA acceptance. Reliable replication depends on accurate data, continuous model updates, and clear communication with passengers. Key prerequisites include a stable professional and financial framework, realistic scheduling, and transparent decision-support processes, integrating modelling results with field insights. Decision on continuation should be based on measurable indicators such as passenger use, service quality, and cost-effectiveness. In Paks, the pilot was continued due to strong emerging demand and expected population growth.

5.2.1.3. Key financial conclusions and recommendations for up-scaling and replication

The Paks pilot shows that financial sustainability depends on managing both investment costs, such as planning, modelling, IT systems and vehicle needs, and ongoing operational expenses for staff, energy, and maintenance. Funding typically combines municipal or state budgets, operator resources and national or EU programmes, supported by multi-year financial planning. Long-term upkeeping may draw on additional grants, partnerships, or reinvested efficiency savings. While scaling up can reduce some fixed costs, smaller settlements may still require new vehicles and staff, limiting economies of scale. Replication elsewhere is feasible through diversified funding, regional cooperation, and the use of external modelling expertise. Stable financing, realistic budgeting, and continuous monitoring remain essential for any wider implementation. Continuation of the pilot solution will be financed by the City of Paks as the customer of the service.

5.2.1.4. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The Paks pilot demonstrates that scaling flexible transport solutions requires clear institutional coordination, supportive legislation, and adaptive operational planning. Replication is suitable for low-demand areas, identified by localised analysis and gradual implementation. Long-term optimisation relies on flexible fleet and staff allocation, improved digital and demand-driven tools, and stable multi-year financing. Expansion can be accelerated through simplified approval procedures and more adaptable public service contracts. Standardised methods for identifying user needs would strengthen planning and comparability.

5.2.2. Key outcomes and upscaling recommendations for Osijek

5.2.2.1. Using transport modelling to plan public transport measures

The Osijek pilot shows that transport modelling is a useful tool for evaluating public transport scenarios, even when initial scenarios do not fully match real demand. The process highlighted the need for accurate data and proper model calibration to ensure reliable results. Despite limitations, modelling supported the comparison of alternatives and provided a clear framework for decision making. Overall, the pilot confirms that well-designed modelling can effectively guide local public transport planning and improvement.

5.2.2.2. Key operational conclusions and recommendations for up-scaling and replication

The Osijek pilot shows that replicating similar public transport measures requires early planning based on a clear assessment of mobility needs and careful coordination among operators, city authorities, and infrastructure managers. Administrative constraints, especially those affecting the installation of temporary or new stops, proved to be a major operational barrier, highlighting the need for advance planning and streamlined procedures. Successful replication also depends on strong operator engagement to validate service feasibility and on institutional support from the city to secure necessary approvals and infrastructure adjustments. Ensuring community support and clear communication further increases the likelihood of smooth implementation. Decisions on continuation of operation of the new line should be based on performance, user interest, and integration with wider network plans. Although these preconditions were met in Osijek, the pilot ended due to an upcoming system-wide reorganisation but the insights for PA will be included in the redesigned network.

5.2.2.3. Key financial conclusions and recommendations for up-scaling and replication

The Osijek pilot shows that the main financial requirements relate to standard operational costs such as fuel, driver engagement, and vehicle depreciation, all of which were covered through the operator's regular budget. While the regular budget was ensured by the operator, a long-term continuation should engage co-financing by other interested public or private bodies. Scaling up the service can improve cost efficiency by optimizing driver schedules and increasing vehicle utilisation across a wider network. Replication in other areas could again rely on operators' regular budgets, complemented where necessary by municipal, regional, or national public transport funds. A diversified financing approach would strengthen financial sustainability, particularly if infrastructure or operational adjustments are required.

5.2.2.4. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The Osijek pilot demonstrates that similar public transport improvements can be applied widely, provided they are grounded in a clear understanding of local mobility needs. Long-term optimisation relies on improved fleet and driver utilisation, gradual passenger growth, and supportive digital tools, which together enhance overall system efficiency. Scaling up requires clearly defined institutional responsibilities and prioritised administrative procedures to avoid delays in approvals and implementation. National legislation already allows pilot measures but streamlined PSO modification processes and reduced documentation would enable faster testing and evaluation. Identifying user needs remains best achieved through detailed local assessments rather than one-size-fits-all methodologies. Financial, operational, and environmental incentives also support a gradual shift to alternative-fuel vehicles and the adoption of interoperable EU-level digital solutions.

5.2.3. Common conclusions and recommendations for scaling up network optimization

Across the pilot examples, scaling up a **public transport network optimisation** measure requires a strong analytical foundation built on reliable transport modelling, continuously updated data and validation through real-world observations and user feedback.

Successful replication depends on early coordination among transport authorities, operators, municipalities, and infrastructure managers, supported by clear institutional roles, streamlined administrative procedures and realistic implementation schedules.

Financial sustainability must balance initial investment needs for planning, modelling and vehicle or IT upgrades, as well as the operational costs for staff, energy, and maintenance. Support through diversified funding that combines operator resources, local and national budgets, EU programmes, and potential co-financing partnerships is optimal.

As services expand, greater efficiency can be achieved through optimised fleet and driver utilisation, demand-responsive planning, and digital tools for real-time management.

Stable governance frameworks, transparent decision-making processes and flexible contractual or regulatory conditions further enhance scalability.

Overall, the pilots demonstrate that with robust data, stakeholder engagement and secure multi-year financing, PT network optimisation measures can be effectively sustained, expanded, and adapted to diverse regional contexts.

5.3. SOLUTION 3: Alternative fuel technologies

5.3.1. Key outcomes and upscaling recommendations for Pécs

5.3.1.1. Key operational conclusions and recommendations for up-scaling and replication

The Pécs pilot shows that up-scaling and replication rely mainly on the strategic commitment of the Municipality of Pécs, which decided to continue serving previously unserved public transport areas beyond the pilot period. With Tüke Busz Plc. as the sole operator, stakeholder roles are clear and the replication process is straightforward. No major operational issues were reported, and stakeholders accepted the pilot outcomes. The municipality's decision to maintain the new connection until June 2026 provides a stable basis for continuation, indicating that political support and operator readiness are the key enablers for sustaining and expanding the pilot solution.

5.3.1.2. Key financial conclusions and recommendations for up-scaling and replication

The Pécs pilot indicates that its financial requirements were minimal, limited primarily to vehicle mileage and driver wages, with all costs covered by OPTI-UP project funding. As no alternative financing options or cost implications for expansion were provided, sustaining or replicating the service would require identifying a stable local funding source once project funding ends. Overall, future continuation and up-scaling depend on municipal commitment and securing reliable operational financing beyond the pilot phase.

5.3.1.3. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The Pécs pilot shows that similar solutions can be applied in other cities with electric bus fleets and unmet transport needs. Long-term improvement would mainly come from increasing service frequency to enhance accessibility. Although no detailed procedural or legislative barriers were identified, maintaining and expanding such services will require clear municipal decisions on financing and operational planning. The main incentive for replication is the environmental and cost advantage of alternative-fuel vehicles. Overall,

successful up-scaling depends on stable local support, adequate funding, and incremental service improvements.

5.3.2. Key outcomes and upscaling recommendations for Český Krumlov

Figure 5: Slides from the presentation of Český Krumlov pilot action results

5.3.2.1. Using transport modelling to plan public transport measures

The Český Krumlov pilot showed that PTV VISUM modelling is a useful tool for assessing public transport improvements, helping stakeholders visualise potential changes in passenger flows, service efficiency, and environmental impacts. Although the results provide only estimates, modelling supported informed discussions and reduced risks before implementing operational changes. Stakeholders stressed that its reliability increases when regularly updated with real data and combined with practical experience and passenger feedback. Overall, the pilot confirmed that transport modelling can effectively guide local public transport planning.

5.3.2.2. Key operational conclusions and recommendations for up-scaling and replication

The Český Krumlov pilot shows that successful up-scaling requires thorough operational preparation, including updated transport plans, secured funding and coordinated procurement of electric vehicles and charging infrastructure. Key actors, the city, public transport operator, regional authorities and infrastructure managers, must work closely together, with additional input from local communities to ensure service acceptance. Replication depends on adequate financial resources, suitable infrastructure, and sufficient operator capacity, while potential challenges include high investment costs and technical requirements for electric mobility. Decisions to continue or expand the pilot should be guided by passenger demand, operational reliability, environmental benefits, and user satisfaction, all of which in Český Krumlov support ongoing development of the solution.

5.3.2.3. Key financial conclusions and recommendations for up-scaling and replication

The Český Krumlov pilot shows that its main financial requirements form investment costs for purchasing an electric bus, installing, or upgrading charging infrastructure and preparing operational conditions, alongside training and passenger-information adjustments. Funding of investment and operational costs was secured

through the OPTI-UP project, municipal resources, and operator contributions, demonstrating the need for mixed financing models. Future sustainability may be supported by national or regional programmes promoting low-emission mobility, while operational optimisation and increased ridership can further improve cost efficiency. Scaling up could reduce operational unit costs through better use of vehicles and staff, although expansion may require additional investment. Replication in other areas is feasible where access to sustainable mobility funds and regional public transport budgets is assured.

5.3.2.4. Institutional, operational, and legislative conditions for scaling-up the pilot solution

The Český Krumlov pilot indicates that similar low-emission public transport solutions can be scaled to other small and medium-sized towns with historic centres or dispersed neighbourhoods. Long-term optimisation depends on expanding the electric fleet, adjusting service frequency to demand, and strengthening digital tools for planning and passenger information. Scaling up requires simpler administrative procedures, clear institutional responsibilities, and stable financing. Although legislation allows temporary pilot adjustments, faster and more flexible approval processes would support smoother implementation. Environmental benefits and operational efficiency strongly incentivise the use of alternative-fuel vehicles, and stakeholders are open to EU-level digital solutions, where compatible and beneficial.

5.3.3. Common conclusions and recommendations for scaling up alternative fuel technologies

Experience from the Pécs and Český Krumlov pilots shows that scaling up alternative-fuel public transport solutions works best when there are strong local commitment, clear responsibilities, and stable funding.

Successful expansion requires reliable financing for both the operation of services and the purchase of electric or other low-emission vehicles and charging infrastructure.

Operational improvements, such as increasing service frequency, optimizing fleet, and driver use, and improving digital tools for planning and passenger information, help make services more efficient and attractive.

Faster and simpler administrative procedures, including approvals for service changes and procurement, support easier implementation.

Lower operating costs, environmental benefits, and positive public perception remain key incentives for using alternative-fuel vehicles. With consistent support and phased improvements, these solutions can be effectively replicated in many different urban contexts.

5.4. Common conclusions from stakeholder consultations

This section summarizes the key conclusions related to maintaining, scaling, and replicating solutions across all three thematic areas, Demand Responsive Transport (DRT), Public Transport (PT) Network Optimization, and Alternative Fuel Technologies, as identified by local stakeholders.

- **Transport modelling** is valuable for scenario testing and planning but must always be paired with real-world data and stakeholder feedback.
- All pilot actions underline the need for **strong institutional coordination** and clearly defined governance roles (in planning, implementation, and monitoring phases).
- **Streamlined administrative and approval procedures** are necessary to speed up implementation and enable flexible pilot adjustments.

- Early and continuous **engagement of operators, municipalities and users** improves feasibility, acceptance, and integration into the wider PT system.
- **Stable, multi-year financing** is essential for sustaining, scaling, and replicating public transport innovations.
- **Digital tools** for planning, monitoring and communication with PT users are key enablers across DRT, network optimisation, and alternative fuel solutions.
- Solutions scale most effectively where **contractual flexibility**, adaptive operational frameworks and supportive legislative conditions are in place.

6. Comprehensive conclusions on PA implementation and performance

The comprehensive conclusions present the final findings on the implementation and performance of the OPTI-UP pilot actions at the project level.

The first part provides a summary analysis of the key strengths, weaknesses, opportunities, and threats of the pilot solutions used by the pilot actions (section 6.1).

The second part synthesises the final conclusions, highlighting the key results of the pilot actions (section 6.2), lessons learned (section 6.3), and factors influencing scaling-up and replicability, together with other relevant insights related to pilot development, implementation, and evaluation (section 6.4).

6.1. Summary of SWOT analysis of pilot actions

The key strengths, weaknesses, opportunities, and threats of the implemented pilot solutions are summarized using the SWOT methodology, mainly from the operational and financial perspective. Three SWOT analyses are applied to examine the main internal and external factors affecting successful implementation of thematic solutions, each implemented in two pilot actions. The thematic solutions:

- Demand responsive transport (DRT)
- PT network optimisation
- Alternative fuels in PT.

6.1.1. Demand responsive transport (DRT)

Table 22: Summary of DRT SWOT analysis

Strengths

[Operational] High flexibility for low demand areas; right sizing vehicle to demand improves coverage.

[Operational] Modelling + operational data help identify low occupancy departures and redesign service.

[Operational] Efficient vehicle assignment (bus/van/car) reduces empty runs and emissions and increases vehicle occupancy.

[Financial] Lower operational costs per trip when replacing large buses with smaller vehicles on low demand runs.

Weaknesses

[Operational] No shows, late cancellations, and confusion with other free mobile services (e.g. city shuttle) depress efficiency.

[Operational] Reliance on call centres for booking limits scalability; users prefer apps.

[Operational] Operational (concession) contract rigidity can limit timetable/vehicle/ PT routes flexibility.

[Financial] Investment costs (booking/dispatch systems, training); integration costs with fixed PT.

[Financial] Uncertainty in vehicle planning and operating costs due to irregular DRT trips.

Opportunities

[Operational] Cross municipal integration broadens service area and improves fleet and staff utilisation.

[Operational] National platforms and interoperable EU level tools standardise booking/monitoring of DRT service.

[Financial] Availability of multiple funding sources (operator/local/national/EU programmes) for scale up.

[Financial] Potential to share costs across municipalities and reduce average cost per trip (share of vehicles, staff, call centre, app).

Threats

[Operational] Complex or slow PSO/contract amendments delay roll out, scaling-up and replication.

[Operational] Incomplete demand data and real-time traffic information reduce the effectiveness of DRT service planning.

[Financial] Volatile funding cycles; insufficient co financing jeopardises continuity of pilot projects.

[Financial] Low uptake in early phases may trigger premature DRT budget cuts for continuation of DRT service.

6.1.2. Public transport (PT) network optimisation

Table 23: Summary of SWOT analysis on PT network optimisation

Strengths

[Operational] Better PT accessibility in consideration of reliability and stability of new PT service

[Operational] Transport modelling provides data-driven PT route/frequency scenarios testing.

[Operational] Punctuality and operational stability achievable with careful timetable design.

[Operational] Iterative fine tuning (stops, headways) improves accessibility and travel times.

[Financial] Uses existing assets; targeted adjustments keep investment needs moderate.

Weaknesses

[Operational] Short pilot duration limits KPI trend detection.

[Operational] Missing/temporary stops reduce utility.

[Operational] Confusing signage of bus line hinders wayfinding and adoption (mis boarding risk).

[Operational] Administrative steps (permits, stop approvals) can be time consuming.

[Financial] Initial low ridership slows payback and weakens cost per passenger metrics.

Opportunities

[Operational] Optimisation and expansion by adding key stops, fine-tuning of line timetable, harmonisation of timetable with other routes and modes.

[Operational] During redesign of the entire network or population growth.

[Operational] Aid of digital tools (e.g. automated passenger counting for planning, or digital platforms for KPI monitoring)

[Financial] Diversified funding options (operator budgets + municipal/regional/national/EU).

[Strategic] Greater emphasis on sustainable, low-emission mobility

Threats

[Operational] External works (e.g., track or road reconstructions) disrupt demand and reliability.

[Operational] Misalignment of stakeholder positions hinders route and stop changes.

[Operational] Organisational capacity and staffing risks on the PTO side.

[Financial] Limited economies of scale in small settlements; risk of excessive costs if demand stays low.

[Strategic] Competition with private cars.

6.1.3. Alternative fuel technologies in PT

Table 24: Summary of SWOT analysis on alternative fuel technologies in PT

Strengths

[Operational] Proven technical feasibility of operating e-buses in varied terrain.

[Operational] Quieter, smoother rides elevate user experience.

[Operational] Positive driver/staff feedback.

[Operational] Telematics enable performance monitoring.

[Financial] Lower energy/maintenance costs over lifecycle vs. diesel (when conditions are favourable).

[Social] Reduction of harmful gas emissions.

Weaknesses

[Operational] Range/charging constraints require duty cycle design and robust operations planning.

[Financial] High investment costs for purchase of vehicles and charging stations, depot upgrades, and training.

Opportunities

[Operational] Phased implementation by changing the existing vehicle fleet.

[Financial] Grants/subsidies (national/EU) for vehicles and infrastructure; zero emission KPIs attract funding.

[Strategic] Strong public opinion on environment

Threats

[Operational] Grid capacity limitations or delays in obtaining permits slow charging stations deployment.

[Financial] Energy price volatility and evolving standards/tech may affect operational cost assumptions.

[Operational] Maintenance capacity and spare parts availability can be challenging for certain types of e-buses.

[Strategic] Policy shifts or procurement delays can stall electric vehicle support programmes.

6.2. Key results of PA and reached expectations

6.2.1. Key outcomes per pilot action

6.2.1.1. PA1 – Modena (Demand-Responsive Transport with mobile app)

Th Modena pilot action introduced a public transport service that people book through a smartphone app. Passengers choose their stop and the system calculates the best route for the minibus.

Key results: The app worked very well, users quickly adopted it, and drivers liked the onboard tools. The system showed good potential to increase shared rides.

Main local impacts: Better access to public transport in low-demand areas; easier booking; improved connection to the fixed PT network.

Objectives met? Yes – digital use increased and operations were stable.

Stakeholder satisfaction: High. Some improvements needed for reporting tools and cancelling trips.

6.2.1.2. PA2 – Grosuplje (Demand-Responsive Transport with fixed schedule)

The Grosuplje pilot used fixed-schedule DRT trips that were operated only if at least one person booked through the call centre. Vehicles were matched to the number of bookings (minibus/e-van/e-car).

Key results: Good operational and environmental performance, low costs, better vehicle occupancy. Users liked the flexibility but wanted more departures and clearer service identity (to better distinguish it from free mobility services).

Main local impacts: Improved mobility in an area with extremely limited PT.

Objectives met? Mostly yes; pilot ended only due to long-term financing rules, not performance.

Stakeholder satisfaction: Mixed. Users liked the idea but wanted more frequent service and weekend operation.

6.2.1.3. PA3 – Paks (New PT line in previously unserved area)

The Paks introduced a completely new bus line connecting homes and workplaces.

Key results: Service was reliable with no delays, but early ridership was very low because the line was new.

Main local impacts: New connection for residents; potential demand expected to grow.

Objectives met? Yes – the line functioned as planned.

Stakeholder satisfaction: Drivers and operators confirmed smooth operations.

6.2.1.4. PA4 – Osijek (New line connecting residential and industrial zone)

A new PT line in Osijek filled a missing connection between a living area and an industrial zone.

Key results: Technically stable, but low ridership. Missing two important stops reduced usefulness. Confusing signage caused people to board the wrong bus.

Main local impacts: Useful connection but hindered by infrastructure gaps.

Objectives met? Partially – service worked, but number of users was lower than expected.

Stakeholder satisfaction: Mostly positive, with clear requests for better signage and additional stops.

6.2.1.5. PA5 – Pécs (Electric bus line in underserved area)

Electric buses were introduced in Pécs to provide a clean, quiet, and modern PT option.

Key results: Users loved the electric buses (comfort, silent ride). Ridership increased slowly. Timetable did not fully match passengers' routines.

Local impacts: Better access to jobs, lower emissions, more positive image of PT.

Objectives met? Yes – environmental and operational improvements achieved; scheduling needs refinement.

Stakeholder satisfaction: Mixed for route/schedule, but very positive for e-bus technology.

6.2.1.6. PA6 – Český Krumlov (Electric minibus for historic/hilly city)

An electric minibus connected neighbourhoods with the centre and regional PT in Český Krumlov.

Key results: Stable operations, strong environmental performance, high passenger satisfaction. E-bus worked very well even in steep terrain.

Local impacts: Reliable zero-emission service adapted to a historic town.

Objectives met? Yes – all main goals achieved.

Stakeholder satisfaction: Very high. Users asked for more frequent service and better information.

6.2.2. Key outcomes per thematic solution

6.2.2.1. Solution 1: Demand-Responsive Transport (Modena + Grosuplje)

Key results:

- Improved accessibility in low-demand areas.
- Digital booking increased user convenience.
- Operational efficiency improved by matching vehicles to demand (minibus, e-van, e-car).

Most important impacts:

- Better coverage for isolated neighbourhoods.
- Lower operational costs and emissions through right-sized vehicles.
- Need for better service promotion and better tools for managing no-shows.

Objectives met?

Mostly yes. Both pilots demonstrated feasibility and user interest, but financial and contractual frameworks must be adapted for long-term operation.

Stakeholder satisfaction:

Mostly positive, with specific improvement requests in Grosuplje: more trips, app-based booking.

6.2.2.2. Solution 2: PT Network Optimisation (Paks + Osijek)

Key results:

- Both new lines operated reliably without disruptions.
- Ridership grew slowly and depended heavily on stop placement and timetable design.
- Modelling helped guide decisions before launching the service.

Most important impacts:

- Showed that simple network adjustments can fill real mobility gaps.
- Revealed the importance of better placement of stops, signage, and integration with the wider PT network.

Objectives met?

Operational reliability achieved; ridership targets require more time and further adjustments.

Stakeholder satisfaction:

Positive regarding operations; constructive criticism on missing stops, confusing signage, and need for better timetable alignment.

6.2.2.3. Solution 3: Alternative Fuel Technologies (Pécs + Český Krumlov)

Key results:

- Electric vehicles performed reliably, even in challenging terrain.
- Strong environmental results (CO_2 reduction, zero-emission kilometres).
- Very positive user perception of comfort and quietness.

Most important impacts:

- Demonstrated that electrification is feasible in small and medium cities.
- Improved image and attractiveness of public transport.

Objectives met?

Yes – main environmental and operational objectives achieved; some timetable and infrastructure improvements still needed.

Stakeholder satisfaction:

High. Users especially appreciated vehicle comfort; authorities supported continuation and expansion.

6.2.3. Overall conclusions on OPTI-UP pilot actions

6.2.3.1. Key results and impacts (local / regional / national)

Across all six pilots, the new public transport (PT) services worked reliably and without major problems. This means that the solutions tested (DRT services, new bus lines, and electric buses) were technically and operationally stable.

- **Local impacts:** Cities saw better access to public transport, especially in areas that previously had weak or no service. Services also became more modern, comfortable, and environmentally friendly.

- **Regional impacts:** Each pilot created a practical example ("template") that other cities in the region can use when introducing similar services, such as app-based DRT, PT line redesign using modelling, or electric buses in small cities.
- **National impacts:** The pilots produced concrete evidence and real data that national authorities can use for future transport planning and funding programmes, for example, data on zero-emission performance, modelling methods, and operational monitoring systems.

6.2.3.2. Most important impacts across all pilots

Across all pilots, four impacts stood out as most important:

- **Better planning through data** – Using transport modelling together with real-world observations helped reduce mistakes and allowed cities to make informed decisions before launching new services.
- **Service design details matter** – Simple elements like good stop locations, clear signage, logical timetables, and easy to understand user information had a big influence on how quickly people started using the new services.
- **Electric vehicles improve both the environment and user experience** – E-buses reduced noise, improved comfort, and lowered emissions, which made the service more attractive and environmentally friendly.
- **Success of DRT and network optimisation depends on flexibility** – Contracts, legal rules, and operating agreements must allow changes to timetables, vehicle types, and operations. Clear service identity (people must understand what the service is and how to use it) is also essential.

6.2.3.3. Objectives and compliance with objectives

Overall, the pilots achieved the main goals that were set at the beginning:

- **Operational goals:** All services worked reliably and performed as expected.
- **Environmental goals:** Electric bus pilots reduced emissions, and DRT pilots reduced unnecessary kilometres by using smaller vehicles when possible.
- **User-related goals:** Passenger numbers increased when services matched real needs (correct stop locations, clear information, appropriate timetables).
- **Financial goals:** The long-term financial viability depends on multiple funding sources and multi-year planning. Pilots showed that services can be sustainable, but only if funding and contractual conditions are adjusted accordingly.

6.2.3.4. Stakeholder satisfaction

Stakeholders, including transport operators, city authorities, drivers, and other professionals, in general expressed satisfaction with the results. They valued that the services ran smoothly, that data supported decision-making (transport modelling), and that environmental and quality improvements were visible.

User satisfaction varied between pilot areas, but it was **highest where:**

- information was clear and easy to understand,
- PT frequency matched daily routines,
- stop locations were convenient, and

- modern, comfortable vehicles were used (especially e-buses).

Stakeholders supported the continuation and scale-up of the services, but emphasised that this depends on:

- faster and simpler approval procedures,
- predictable and stable financing, and
- improved digital tools for planning, monitoring, and user information (on new services).

6.3. Lessons learned and suggestions for replicability

6.3.1. Key legacy of the whole OPTI-UP pilot programme

- All six pilots proved that small and medium-sized cities can successfully modernise their public transport using flexible DRT, optimised routes, and electric buses.
- The programme created real examples that can be transferred to many other European cities.

6.3.2. Suggestions for stakeholders wanting to replicate

- With transport modelling, combine data analysis (modelling) with field validation.
- Start small (pilot actions), monitor closely, and adjust early (manage issues and discrepancies).
- Prepare effective communication strategies: users must clearly understand what is new and how to use it.
- Secure long-term funding and flexible contracts before scaling up.

6.3.3. Suggestions for different implementation of the pilot actions

- Increase the duration of pilots to better observe ridership trends.
- Strengthen communication and marketing at the start of each pilot.
- Introduce more unified digital tools across pilots (apps, real-time info, monitoring dashboards).
- Harmonise KPIs among pilots.

6.3.4. Advice to other cities and stakeholders

- Do not underestimate the importance of stop locations, timetable design, and user information as they strongly influence ridership.
- For DRT: focus on user-friendly booking systems; for better acceptance introduce additional services (e.g. expansion of timetables) when reducing the existing ones (regular trips to DRT trips).
- For network optimisation: ensure full stop infrastructure readiness.
- For e-buses: invest early in maintenance capacity and charging systems.
- Always involve local communities, operators, and authorities early to build acceptance.

6.4. Strategies for the pilot actions follow-up

6.4.1. Possibilities and approach for continuation

- Most pilots can continue with minor operational adjustments (stops, schedules, digital tools/automated data collection/databases/digital user feedback tools).
- Pilots with electric buses showed strong user support, making continuation likely.
- DRT pilots can be scaled if funding and booking platforms are secured.
- PT network pilots will continue where broader citywide reorganisations are planned.

6.4.2. Prerequisites for continuation or revival of pilot solutions

- Stable funding (municipal + national + EU).
- Improved infrastructure (missing stops, charging stations, signage).
- Clear institutional roles and flexible PSO contracts.
- Effective communication and user information to build ridership.
- Reliable data sources and automatic data collection for continuous monitoring.

6.4.3. Synergies with other PT solutions/projects

- High potential for integration with:
    - regional PT systems,
    - national low emission and digitalisation strategies,
    - EU programmes (Social Climate Fund, Cohesion Fund, CEF Transport, Green Deal),
    - multimodal hubs and MaaS platforms,
    - upcoming tram or bus network redesigns.