



**UNLOCKING LARGE-SCALE ACCESS TO COMBINED MOBILITY
THROUGH A EUROPEAN MAAS NETWORK.**

Deliverable D5.2 IMOVE First Evaluation Report, initial impact assessment

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Deliverable D5.2

IMOVE First Evaluation Report, initial impact assessment

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Executive Summary

The purpose of this deliverable is to provide the initial evaluation results of IMOVE Living Labs by applying impact and process assessment and to validate the “as is” measurements of the KPIs identified in D5.1.

The deliverable follows the methodology defined in the evaluation plan (D5.1) and results were collected with questionnaires or direct interviews to Living Lab partners and stakeholders.

After an introductory section, summarising the main outcomes reported in the deliverable, section 1 describes the Business as Usual (BaU) analysis, allowing the sound assessment of project indicators taking into account their natural evolution that could happen independently from project actions. This analysis was applied, where possible, to every indicator in each Living Lab and will be refined and updated in the next period.

In section 3 the Impact evaluation is proposed, with detailed baseline values collected and validated in each Living Lab, that will serve an initial measurement to assess project progresses.

In section 4 the Process evaluation is presented, for both software developers and implementers: criticalities and risks were collected and analysed and will be proposed to the consortium for the necessary mitigation actions.

The conclusions section provides a summary of findings of recent WP5 activities and the actions to be undertaken in the next period.

Abbreviations and Acronyms

BaU	Business as Usual
DDP	Deliverable Development Plan
DoA	Description of Action
ERB	Ethics Review Board
LL	Living Lab
LTZ	Limited Traffic Zone
MaaS	Mobility as a Service
PT	Public Transport
WP	Work Package

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INTRODUCTION

The focus of this deliverable is essentially twofold:

- To set the initial measurement baseline, by verifying if the observational systems, intended as the groups of local actors in the Living Labs, are appropriately organised and working according to plans identified both in WP4 and WP5 preliminary stages;
- To ensure that project activities are proceeding according to initial requirements and to identify potential issues that may have negative impacts in the Living Labs.

Living Lab, as the name says, is a dynamic test environment where innovations are analysed in real operational contexts. For this reason, the impact and evaluation activities carried out by WP5 will be a continuous process fed by Living Lab data (WP4) and technical contributions (WP2 and WP3) throughout the duration of the IMOVE project.

In this report, KPIs initially identified in D5.1 have been assessed and “ex ante” measurements provided when possible. For some KPIs it was not possible to collect measurements and a further attempt will be done in the next period: local partners will be invited to actively work for providing measurements and ensuring deep and accurate data collection. This process will continue in the next period and will be reported in future deliverables along with “ex post” assessments once operational activities will have started and the MaaS offer is available to end-users.

The report also provides relevant insights about detected risks and issues that will be reported to interested partners and to the project management team for taking appropriate mitigation actions.

1 BUSINESS AS USUAL ANALYSIS

The Task 5.3 deals with evaluation of the outcomes produced by IMOVE in each Living Lab. The task started performing a Business-as-usual (BAU) analysis based on relevant process innovations (both the Scalability Unlockers and the Software Enablers) brought by IMOVE in urban transport market and affecting the travel experience of citizens. This activity was done in order to identify differences between traditional integrated mobility schemes and the MaaS schemes that are intended to be a step beyond the usual multimodal travel experiences in covering travel behaviour, business models and data exchange aspects in a single integrated service offer. Concretely the BAU is aimed to respond to the question: “what will happen if IMOVE innovation will not be put in place?”

At the time of the preparation of this deliverable (Month 15), the Living Lab activities started with preparatory actions (organisational settings, operational plans and technical integrations) but did not provide services to end-users yet. For this reason, the Business as Usual analysis carried out *before* the beginning of operational services will try to address the above mentioned question with an *inductive reasoning*, by inferring the evolution of main indicators in a time horizon of 2 years without any of the technological, business, regulatory or policy innovation that IMOVE is currently implementing in the sites, hence observing the “natural” evolution brought by other external factors. The indicators addressed by this specific evaluation are the KPIs selected in preparatory stages (reported in D5.1), measuring the context affected by Living Lab MaaS proposals. The impact evaluation of the selected indicators in each Living Lab will therefore be assessed by measuring the final values of KPIs deducted by the BaU estimated value, as represented in figure 1.

Business as Usual analysis will continue in the next months, updating estimated progress of indicators that will be monitored either in comparable conditions, i.e. different target groups not directly affected by IMOVE actions, or other similar contexts suitable to represent the progress of any indicator.

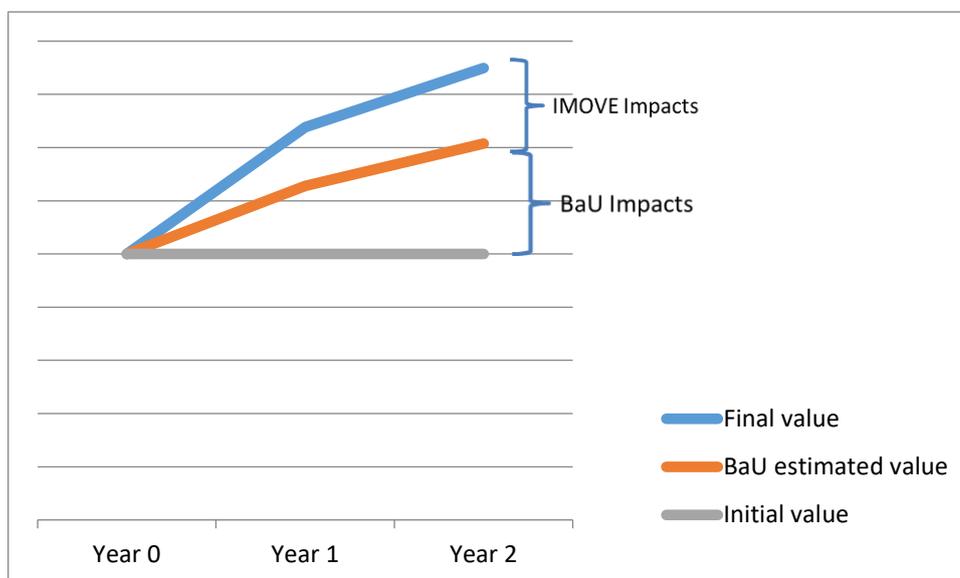


Figure 1. BaU and Impact evaluation

The following subsections report the outcomes of the initial Business as Usual analysis conducted in each Living Lab.

1.1 BUSINESS AS USUAL ANALYSIS FOR TURIN LIVING LAB

The city of Turin has initiated since some years an innovation path aimed at scouting new technologies, models and mobility schemes for facing the urban congestion issue that is due to a high car ownership rate and the attitude of citizens to use individual transport means.

The city is participating in several research projects and is currently experimenting with public-private initiatives for deploying electric transport, shared mobility services, LTZ innovative regulations etc.

In this dynamic context, it is crucial to estimate the potential progress of transport indicators that will happen independently from the IMOVE project, in order to accurately assess the benefits brought by each single initiative and then provide public decision-makers with concrete cost-benefit outputs.

The following table reports, whenever possible, per each selected KPI, the estimated value that will be reached in a time horizon of the next 2 years, assuming that no new MaaS service will be made available.

Table 1. Business as Usual analysis for the Turin Living Lab

Project Target	Indicator name	Indicator definition	Business as Usual
<p>Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers</p>	<p>Interoperability between MaaS and Journey Planners</p>	<p>Number of Journey Planners provided by or connected to the MaaS operator platform</p>	<p>Apart from universal Journey planners already present in the market (Google, Citymapper, Moovit, etc.) that may extend their features including transport/tariffs aggregations services and MaaS schemes, the city is developing their own journey planning tools:</p> <ol style="list-style-type: none"> 1. Muoversi a Torino (muoversiatorino.it) is essentially an infomobility tool, provided by 5T and it is not expected to evolve as ticketing instrument in the near future. 2. URBI MaaS app is directly correlated to the IMOVE project. <p>In addition to the abovementioned services, the GTT journey planner, provided by the local Public Transport Company, will be soon improved, including mobile ticketing services. Therefore, this journey planner will be released independently from IMOVE solutions and could reasonably considered as one Business as Usual evolution for the targeted indicator</p>

<p>Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers</p>	<p>Interoperability between MaaS and other apps</p>	<p>Number of generic mobile apps connected to the MaaS operator platform</p>	<p>Current experiences are beginning to link some mobility services (i.e. parking, fuel) to official public services. They are not integrated with existing travel-planners yet but it is reasonable to expect that 3 of them could be in the next 2 years.</p>
<p>Target 3: +30% of trips generated by the journey planners connected with IMOVE</p>	<p>Utilisation of Journey Planners</p>	<p>Number of travel queries submitted to Journey Planners connected to the MaaS operator</p>	<p>Considering the trend of recent years, Muoversi a Torino (the 5T journey planner) is expected to reach a yearly growth rate of about 5% in the next 2 years, independently from additional services to be launched. Urbi is specifically focused on MaaS scheme and cannot be taken as reference for BaU.</p>
<p>Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE</p>	<p>Multimodal trips</p>	<p>Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated</p>	<p>The data about intermodal trips is not available at the moment but it is possible to estimate the evolution of intermodal trips considering a) Park&Ride usage, which is stable according to EMTA Barometer data¹ and b) integrated train-bus ticketing, recently introduced and considered stable too. Therefore, it is reasonable to estimate a stable evolution for the next 2 years as BaU.</p>

¹ <http://mtm.torino.it/en/facts-and-figures>

<p>Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport</p>	<p>Integrated ticketing</p>	<p>Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total</p>	<p>Due to recent changes in tariff model, this data is not available at the moment, this indicator as BaU will be monitored in next months and updated according to future evolution in the Living Lab.</p>
<p>Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas</p>	<p>Purchasing user experience</p>	<p>Time required for buying an online ticket</p>	<p>Purchasing procedures are still with vending machines or at kiosks but in the next months a mobile app selling integrated ticketing will be provided. Therefore, the BaU value can be assumed equal to the baseline, once the mobile app for ticketing will be available; this data will be assessed later.</p>
<p>Target 8: One brand awareness campaign per each of the five Living Lab, focused on a clear identification of the new mobility model empowered by the IMOVE SW enablers</p>	<p>MaaS awareness</p>	<p>Number of dissemination actions aimed at improving the awareness of the MaaS offer</p>	<p>Two main campaigns related to integrated ticketing (promoted by Region and Municipality) have recently been carried out and reasonably should continue in the next 2 years.</p>
<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, and supporting the MaaS scheme</p>	<p>The city of Turin is actively working on supporting MaaS uptake. Other initiatives are currently taking place besides IMOVE and will probably generate other MaaS experiences. Therefore, this indicator as BaU will be monitored in next months and updated according to future evolution in the Living Lab.</p>

<p>Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)</p>	<p>IT interoperability</p>	<p>Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme</p>	<p>Currently there is not a data interchange among transport operators, except than between 5T and the public transport company GTT. However, considering current ongoing projects, it can be estimated that some operators for car sharing and bike sharing could implement data exchange procedures in the range of about 5. Nevertheless, the situation is fluid and will be monitored during the next months.</p>
<p>Target 14: at least one local agreement among all transport operators, aiming at reaching environmental targets, according to local policies</p>	<p>Agreement among local operators</p>	<p>Commercial or technical agreements regulating MaaS operations among local subjects</p>	<p>The city of Turin is actively working on supporting MaaS uptake. Other initiatives are currently taking place besides IMOVE and will probably generate other MaaS experiences. Therefore, this indicator as BaU will be monitored in next months and updated according to future evolution in the Living Lab</p>
<p>Target 15: at least 3 ancillary services per LL, complementing transport provision included in existing MaaS in LL areas (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels)</p>	<p>Ancillary Services</p>	<p>Number of additional services (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels) offered besides the MaaS scheme</p>	<p>One existing service dedicated to students and correlated to integrated ticketing has recently been cancelled. Current estimation could consist in considering stable (as non-existing) the number of ancillary services for next 2 years. However, this indicator will be monitored in next years.</p>

Promoting modal shift, transport efficiency and reduction of externalities generated by traffic	Transport Modal shift	% of trips made by each transport mode	<p>Data retrieved from EMTA reports on 2012 and 2015 show an evolution trend that can be assumed as BaU for next years:</p> <ul style="list-style-type: none"> • Motorised modes: -2.7% • PT: -0.8% • Soft modes (cycling, walking): +3.3%
	Daily average distance	Overall distance travelled per day per user	<p>Distance and journey time are not available in aggregated mode. For this reason, it has been considered to use the number of average daily trips that will be monitored and compared in the Living Lab activities. Overall the number of movements since (time records 2003-2013) is decreasing but external factors may have affected these figures, therefore a more prudent decrease of about 3% is considered reasonable</p>
	Total journey time	Average duration of journey from origin to destination	
	Travel Costs	Total travel cost per individual/household	<p>This data is not available in aggregated mode and will be further investigated in next project period</p>

1.2 BUSINESS AS USUAL ANALYSIS FOR GREATER MANCHESTER LIVING LAB

Table 2. Business as Usual analysis for the Manchester Living Lab

Project Target	Indicator name	Indicator definition	Business as Usual
Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers	Interoperability between MaaS and Journey Planners	Number of Journey Planners provided by or connected to the MaaS operator platform	No change is expected without intervention.
Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers	Interoperability between MaaS and other apps	Number of generic mobile apps connected to the MaaS operator platform	It is expected that as the smartphone penetration increases the number of journey planning requests will increase. No new apps are particularly expected to launch, but there is scope for these to take us by surprise (e.g. CityMapper)
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	No change is expected without intervention.
Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE	Multimodal trips	Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated	Estimation not available. An additional investigation will be done in next months for the collection of this data if available. BaU value will then be produced according to future evolution in the Living Lab

<p>Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport</p>	<p>Integrated ticketing</p>	<p>Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total</p>	<p>The Living Lab is currently awaiting feedback from Ticketing and Fares department relating this data that will be produced in the next months, allowing the BaU estimation.</p>
<p>Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas</p>	<p>Purchasing user experience</p>	<p>Time required for buying an online ticket</p>	<p>TfGM has limited influence on multi-modal products, which are retailed by a third party (Greater Manchester Ticketing Limited - GMTL). A Fares and Ticketing Strategy for TfGM is being developed, and smart ticketing (and its purchase) will be part of this. However, it is not possible to give a precise time.</p>
<p>Target 8: One brand awareness campaign per each of the five Living Lab, focused on a clear identification of the new mobility model empowered by the IMOVE SW enablers</p>	<p>MaaS awareness</p>	<p>Number of dissemination actions aimed at improving the awareness of the MaaS offer</p>	<p>Unknown at this time, but TfGM has regular campaigns around products, e.g. during the summer, TfGM campaigns around school bus products.</p>
<p>Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%</p>	<p>Shared Mobility penetration</p>	<p>Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments</p>	<p>Greater Manchester is currently exploring new co-mobility options, including a GM-wide Car Club and a new Public Bike Hire scheme, both of which should be operational within 2 years</p>

<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme</p>	<p>No MaaS operators are currently looking at launching in Manchester. The MaaS4EU trial will have ended in 2 years.</p>
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1.3 BUSINESS AS USUAL ANALYSIS FOR BERLIN LIVING LAB

The MaaS offer in Berlin should be launched in the last quarter of 2018; recent operational activities did not show relevant problems. The city presents several new mobility services growing in the recent period; for this reason, estimating in inductive mode some of the baseline values is not easy. The evolution of some indicators where estimation has revealed problematic will be monitored in the next months and data updated accordingly.

Table 3. Business as Usual analysis for the Berlin Living Lab

Project Target	Indicator name	Indicator definition	Business as Usual
<p>Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers</p>	<p>Interoperability between MaaS and Journey Planners</p>	<p>Number of Journey Planners provided by or connected to the MaaS operator platform</p>	<p>Reasonably 2 other journey planners are active and popular in Berlin, free2move and citymapper, they could integrate the IMOVE offering. The only available metric to quantify usage is the downloads from the relative app stores. It is reasonable to expect that these 2 journey planners will still be available in the next 2 years and connected to Urbi MaaS platform.</p>

<p>Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers</p>	<p>Interoperability between MaaS and other apps</p>	<p>Number of generic mobile apps connected to the MaaS operator platform</p>	<p>Considering the apps already integrated at present, that cover almost all urban mobility offers, the BaU would remain stable if no new MaaS would take place in the next 2 years. Therefore, the BaU value can be assumed equal to the current baseline.</p>
<p>Target 3: +30% of trips generated by the journey planners connected with IMOVE</p>	<p>Utilisation of Journey Planners</p>	<p>Number of travel queries submitted to Journey Planners connected to the MaaS operator</p>	<p>Estimation not available. The utilisation of journey planners will be monitored in next months and BaU value updated according to future evolution in the Living Lab.</p>
<p>Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE</p>	<p>Multimodal trips</p>	<p>Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated</p>	<p>Estimation not available. The multimodal trips will be monitored in next months and BaU value updated according to future evolution in the Living Lab.</p>
<p>Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport</p>	<p>Integrated ticketing</p>	<p>Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total</p>	<p>Estimation not available. The integrated ticketing will be monitored in next months and BaU value updated according to future evolution in the Living Lab.</p>
<p>Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas</p>	<p>Purchasing user experience</p>	<p>Time required for buying an online ticket</p>	<p>Estimation not available. The Purchasing user experience will be monitored in next months and BaU value updated according to future evolution in the Living Lab</p>

<p>Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%</p>	<p>Shared mobility penetration</p>	<p>Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments</p>	<p>Estimation not available. The Purchasing user experience will be monitored in next months and BaU value updated according to future evolution in the Living Lab</p>
<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme</p>	<p>7 stakeholders were already active before IMOVE start and this number will reasonably stay stable for next 2 years</p>
<p>Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)</p>	<p>IT interoperability</p>	<p>Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme</p>	<p>Not applicable, BaU will be considered equal to the Baseline</p>
<p>Target 16: Halving the payback period of investment for ICT booking/ticketing services and devices in LL areas</p>	<p>Financial improvements</p>	<p>Payback period of IT investment cost</p>	<p>Estimation not available. The Financial improvements will be monitored in next months and BaU value updated according to future evolution in the Living Lab</p>

Promoting modal shift, transport efficiency and reduction of externalities generated by traffic	Total journey time	Average duration of journey from origin to destination	Estimation not available. The Total journey time will be monitored in next months and BaU value updated according to future evolution in the Living Lab
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1.4 BUSINESS AS USUAL ANALYSIS FOR GOTHENBURG LIVING LAB

The Gothenburg Living Lab is divided into 3 different pilots proposing specific and targeted MaaS services. In addition, other MaaS initiatives were already proposed (either in experimental mode or as early-stage services) and this situation leads to difficulties in clearly identifying the Business as Usual scenario, as future evolution in MaaS context are already happening and bundling effects (intended as interdependencies among services affecting the same indicators) are possible. Therefore, refinements of this analysis will be proposed in the next reports.

Table 4. Business as Usual analysis for the Gothenburg Living Lab

Project Target	Indicator name	Indicator definition	Business as Usual
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	There are other MaaS initiatives concurrent to IMOVE and already in progress, therefore this indicator may be affected by bundling effects. In addition, many of the journeys managed by the IMOVE Living Lab would be daily commute journeys where the customer probably do not need a planner to decide which journey to take. A detailed comparative analysis on several MaaS schemes will be carried out ex-post.
Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas	Purchasing user experience	Time required for buying an online ticket	Estimation not available. The Purchasing user experience will be monitored in next months and BaU value updated according to future evolution in the Living Lab

<p>Target 7: -5% of operating costs for collective transports connected by MaaS proprietary platforms in LL areas</p>	<p>Operating costs for MaaS operators</p>	<p>Annual Operating costs for MaaS operators</p>	<p>There are other MaaS initiatives concurrent to IMOVE and already in progress, therefore this indicator may be affected by bundling effects. A detailed comparative analysis on all MaaS will be carried out ex-post</p>
<p>Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%</p>	<p>Shared mobility penetration</p>	<p>Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments</p>	<p>Sweden's largest carpool operator (Sunfleet) grew by 25% in 2017. We expect similar growth in the next two years.</p> <p>2035 modal split targets for Gothenburg city:</p> <ul style="list-style-type: none"> • Walk: 22% • Bicycle: 13% • Public transport: 36% • Car: 29%
<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme</p>	<p>There are other MaaS initiative concurrent to IMOVE and already in progress, therefore this indicator may be affected by bundling effects. A detailed comparative analysis on all MaaS will be carried out ex-post</p>

<p>Target 15: at least 3 ancillary services per LL, complementing transport provision included in existing MaaS in LL areas (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels)</p>	<p>Ancillary Services</p>	<p>Number of additional services (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels) offered besides the MaaS scheme</p>	<p>The focus is primarily on getting the basic mobility services in place before exploring the potential of ancillary services. A detailed comparative analysis on all MaaS will be carried out ex-post</p>
<p>Promoting modal shift, transport efficiency and reduction of externalities generated by traffic</p>	<p>Transport Modal shift</p>	<p>% of trips made by each transport mode</p>	<p>We assume that MaaS services will only marginally influence modal split in the next two years, such that the statistics provided in the answers to target 9 for baseline are likely to be valid. We expect a more significant impact in the next 5-10 years after MaaS services are launched on a commercial basis and begin to diffuse.</p>
	<p>Total journey time</p>	<p>Average duration of journey from origin to destination</p>	<p>We assume that travel times will remain relatively constant over the next two years</p>

2 INTRODUCTION TO IMPACT AND PROCESS ASSESSMENT

The evaluation framework will be deployed in the IMOVE Living Labs to carry out impact and process evaluation of the project solutions and methodologies, comparing the measured **outputs** and **outcomes** of IMOVE solution application in the Living Labs.

The contribution of IMOVE in reaching the identified strategic objectives and expectations will be assessed for each Living Lab according with the Scalability Unlockers and Software Enablers which will be defined in the respective Living Labs. Defining indicators without setting targets and making clear the specific understanding of “success” means not to be able to really appreciate if the effort and investment devoted to the identified solutions, system or project, has brought effective added value or not, and if the expected “payback” or “return” from the invested effort has been appropriate. Finally, only with a recognized success can there be reasonable potentials for replication, deployment, exploitation and scalability of the IMOVE solution. For these reasons expected targets have been set in the project proposal and will be considered as guiding principles during the evaluation activities.

The evaluation methodology, proposed in D5.1, indicates to what extent the application of IMOVE solutions in the Living Labs will improve behavioural change towards sustainable mobility modes, improving public transport offering, etc.

The evaluation methodology has been elaborated to perform:

- **impact evaluation** (by Key Performance Indicators - KPIs)
- **process evaluation** (determining drivers and barriers).

The following sections address these aspects and present initial outcomes of the overall evaluation process.

3 IMPACT EVALUATION

In all Living Labs a dedicated questionnaire has been administered and data reporting the “as is” values of each defined KPI was collected. The Living Lab leader was in charge to submit specific questions and to collect data from official sources, as well as to validate data and ensure their accuracy.

The following subsections present initial results collected at Month 15 of the project.

3.1 TURIN

Table 5. Baseline measurements for the Turin Living Lab

Project Target	Indicator name	Indicator definition	Baseline (at beginning of IMOVE project)
Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers	Interoperability between MaaS and Journey Planners	Number of Journey Planners provided by or connected to the MaaS operator platform	0
Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers	Interoperability between MaaS and other apps	Number of generic mobile apps connected to the MaaS operator platform	0
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	No MaaS operator yet. As reference it is possible to consider the Muoversi a Torino multi-modal travel planner (https://www.muoversiatorino.it) provided by 5T that records about 200.000 queries/year

<p>Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE</p>	<p>Multimodal trips</p>	<p>Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated</p>	<p>The data about intermodal trips is not available at the moment; a further investigation will be made for producing this date before the beginning of the MaaS pilot.</p>
<p>Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport</p>	<p>Integrated ticketing</p>	<p>Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total</p>	<p>Due to recent changes in tariff model, this data is not available at the moment; a further investigation will be made for producing this date before the beginning of the MaaS pilot.</p>
<p>Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas</p>	<p>Purchasing user experience</p>	<p>Time required for buying an online ticket</p>	<p>Purchasing procedures are still with vending machines or at kiosks but in the next months a mobile app selling integrated ticketing will be provided. Therefore, it can be assumed that the purchasing time will be in the range of few minutes, but this data will be further assessed once the mobile app will be available</p>
<p>Target 8: One brand awareness campaign per each of the five Living Lab, focused on a clear identification of the new mobility model empowered by the IMOVE SW enablers</p>	<p>MaaS awareness</p>	<p>Number of dissemination actions aimed at improving the awareness of the MaaS offer</p>	<p>Two main campaigns related to integrated ticketing.</p>

Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas	Number of MaaS involved subjects	Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme	0
Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)	IT interoperability	Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme	1 (5T and GTT)
Target 14: at least one local agreement among all transport operators, aiming at reaching environmental targets, according to local policies	Agreement among local operator	Commercial or technical agreements regulating MaaS operations among local subjects	0
Target 15: at least 3 ancillary services per LL, complementing transport provision included in existing MaaS in LL areas (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels)	Ancillary Services	Number of additional services (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels) offered besides the MaaS scheme	0
Target 17: 10 novel targeted business models (2 scenarios per LL) for integrated mobility services	New business models	Number of targeted business models for integrated mobility services	1 (Formula ticketing integrating train and bus)

<p>Impact on competitiveness, attractiveness and quality of transport services</p>	<p>Quality of service</p>	<p>Perception of quality of service</p>	<p>Survey administrated on 2013 by the regional agency of mobility²</p> <p>PT:</p> <ul style="list-style-type: none"> • Easiness in purchasing tickets: 89.8% • Safety of PT: 83.4% • Enforcement efficacy: 68% • Park & Ride facilities: 56.6% • Convenience of ticketing: 68.1% <p>Car:</p> <ul style="list-style-type: none"> • Trip comfort: 95.2% • Privacy on-board: 93.7% • Transport of people and goods: 93.8% • Road maintenance: 62.5% • Easiness in parking: 62% • Economic convenience: 56.6% <p>Bicycle:</p> <ul style="list-style-type: none"> • Economic convenience: 98% • Environmental compatibility: 97% • Trip comfort: 93.2% • Bike lanes maintenance: 63.5% • Safe crossings: 60.4% • Secure parking: 61.5%
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² <http://mtm.torino.it>

Promoting modal shift, transport efficiency and reduction of externalities generated by traffic	Transport Modal shift	% of trips made by each transport mode	Data retrieved from EMTA reports on 2015: <ul style="list-style-type: none"> • Motorised modes: 39.8% • PT: 24.3% • Soft modes (cycling, walking): 36.7%
	Daily average distance	Overall distance travelled per day per user	Distance and journey time are not available in aggregated mode. For this reason, it has been considered to use the number of average daily trips: 2,11 trips. 1,40 of them are motorised (source regional agency of mobility).
	Total journey time	Average duration of journey from origin to destination	
	Travel Costs	Total travel cost per individual/household	This data is not available in aggregated mode and will be further investigated in next project period

3.2 GREATER MANCHESTER

Table 6. Baseline measurements for the Manchester Living Lab

Project Target	Indicator name	Indicator definition	Baseline (at beginning of IMOVE project)
Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers	Interoperability between MaaS and Journey Planners	Number of Journey Planners provided by or connected to the MaaS operator platform	Transport for Greater Manchester has a web-based journey planner: https://my.tfgm.com/#/planner/

Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers	Interoperability between MaaS and other apps	Number of generic mobile apps connected to the MaaS operator platform	Currently 0. However, there are many connected to the existing journey planners and related apps that are run by private companies and data is not available.
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	The Living Lab is currently awaiting feedback from Information Service department relating to this data.
Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE	Multimodal trips	Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated	Estimation not currently available. An additional investigation will be done in next months for the collection of this data.
Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport	Integrated ticketing	Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total	This data will be released by the Ticketing and Fares department in a future period, once MaaS operations will be started.
Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas	Purchasing user experience	Time required for buying an online ticket	A dedicated user group will be set in the next period for estimating the current purchasing time that will be release in the next deliverable.
Target 8: One brand awareness campaign per each of the five Living Lab, focused on a clear identification of the new mobility model empowered by the IMOVE SW enablers	MaaS awareness	Number of dissemination actions aimed at improving the awareness of the MaaS offer	1: promotion of ITSO smartcard which is used for multi-modal products. ITSO is the national smart ticketing standard (except London). https://www.itso.org.uk/

<p>Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%</p>	<p>Shared Mobility penetration</p>	<p>Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments</p>	<p>Negligible.</p>
<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme</p>	<p>Although TfGM has operated one "MaaS Trial" this was not actual MaaS but simulated, therefore 0.</p>
<p>Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)</p>	<p>IT interoperability</p>	<p>Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme</p>	<p>0</p>
<p>Target 19: Technical specifications and related roadmap for roaming services (one per LL) involving other cities and areas outside LLs, as a result of LL local workshops</p>	<p>Promotion of roaming Services</p>	<p>Technical and commercial specification for Roaming Services among MaaS schemes</p>	<p>There is no existing specification for roaming.</p>
<p>Promoting modal shift, transport efficiency and reduction of externalities generated by traffic</p>	<p>Perceived accessibility</p>	<p>Perceived accessibility to transport services</p>	<p>This data is currently not available: a specific focus group will be set-up for defining a suitable metric for evaluating a qualitative indicator and retrieving measurements.</p>

Impact to standards and regulations	New standard or regulations	Impact to standards and regulations related to multimodality, integrated ticketing, etc.	Anti-Competition Law - block ticketing exemption
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3.3 BERLIN

Table 7. Baseline measurements for the Berlin Living Lab

Project Target	Indicator name	Indicator definition	Baseline (at beginning of IMOVE project)
Target 1: At least three popular journey planners connected with existing MaaS platforms pertaining to the five Living Labs through the SW enablers	Interoperability between MaaS and Journey Planners	Number of Journey Planners provided by or connected to the MaaS operator platform	1 (Urbi)
Target 2: At least five non-travel-planner mobile apps will be connected to each MaaS platform in each Living Lab through the SW enablers	Interoperability between MaaS and other apps	Number of generic mobile apps connected to the MaaS operator platform	4 mobility apps: <ul style="list-style-type: none"> • Driveby carsharing • Emmy scootersharing • Nextbike bikesharing • - VBB ticket selling
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	Queries: <ul style="list-style-type: none"> • Day: 2.600 • Month: 65.200 • Year: 783.000

Target 4: +8% of intermodal trips generated by journey planners connected to IMOVE	Multimodal trips	Number of trips combining different modes of transport resulting from Journey Planner responses out of total trips generated	25% of the total outlined above.
Target 5: +25% use of integrated ticketing for mobility services in areas covered by the LLs, of which +5% relates to tickets involving more than one mode of transport	Integrated ticketing	Number of tickets for any urban trip (PT, taxi, car sharing, etc.) sold via the integrated ticketing channel out of the total	This data is not available at the moment; a further investigation will be made for producing this data before the beginning of the MaaS pilot
Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas	Purchasing user experience	Time required for buying an online ticket	4 minutes
Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%	Shared mobility penetration	Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments	This data is not available at the moment; a further investigation will be made for producing this data before the beginning of the MaaS pilot
Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas	Number of MaaS involved subjects	Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme	0

Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)	IT interoperability	Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme	7
Target 16: Halving the payback period of investment for ICT booking/ticketing services and devices in LL areas	Financial improvements	Payback period of IT investment cost	Data not available at the moment, this indicator will be investigated in the next period
Promoting modal shift, transport efficiency and reduction of externalities generated by traffic	Total journey time	Average duration of journey from origin to destination	Data not available at the moment, this indicator will be investigated in the next period

3.4 GOTHENBURG

Table 8. Baseline measurements for the Gothenburg Living Lab

Project Target	Indicator name	Indicator definition	Baseline (at beginning of IMOVE project)
Target 3: +30% of trips generated by the journey planners connected with IMOVE	Utilisation of Journey Planners	Number of travel queries submitted to Journey Planners connected to the MaaS operator	0
Target 6: Halving of total time spent to purchase intermodal travel services online by users travelling by services by the LLs areas	Purchasing user experience	Time required for buying an online ticket	Not applicable.

<p>Target 7: -5% of operating costs for collective transports connected by MaaS proprietary platforms in LL areas</p>	<p>Operating costs for MaaS operators</p>	<p>Annual Operating costs for MaaS operators</p>	<p>This KPI will not be measured as getting data may be difficult. Instead, process evaluation surveys will be done (see related procedures)</p>
<p>Target 9: a) Increase of collective transport use and car/van sharing by 10%; b) Increase of collective transport use by students and elderly people by 20%; c) Decrease of private car ownership by 5%</p>	<p>Shared mobility penetration</p>	<p>Number of journey segments using shared vehicle services (Car sharing, carpooling, taxi sharing) per user as % of total journey segments</p>	<p>The shared mobility % is not currently available.</p>
<p>Target 11: at least 10 MaaS involved actors per LL (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) as objective of SUMP and other mobility strategy local agendas</p>	<p>Number of MaaS involved subjects</p>	<p>Number of legal entities (transport providers, ITS companies, research entities and other involved service providers included in all the MaaS local schemes) involved in planning, operating, monitoring, supporting the MaaS scheme</p>	<p>Hundreds of actors have been involved in previous and ongoing MaaS-related activities. In 2016 Västtrafik opened a Request for Information on MaaS, which engaged hundreds of companies and other stakeholders. There are numerous other projects that engage or have engaged actors from both the public and private sectors, such as the Go:Smart project which trialled the world's first combined mobility service.</p>
<p>Target 12: At least one data sharing process per each involved operator with another LL actor (subscriptions, profiling, common data model)</p>	<p>IT interoperability</p>	<p>Number of data exchange processes among operators (transport providers, IT operators, etc.) in the MaaS scheme</p>	<p>The main ticketing/data exchange service in LLGOT is "BoB", which is an open API that is deployed in the existing ToGo app (VT) and all digital ticketing solutions. See: Bob.samtrafiken.se.</p>

<p>Target 15: at least 3 ancillary services per LL, complementing transport provision included in existing MaaS in LL areas (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels)</p>	<p>Ancillary Services</p>	<p>Number of additional services (parcel delivery, long distance trip booking, mobility management and/or loyalty programs and other facilities linked to urban travels) offered besides the MaaS scheme</p>	<p>P-bolaget - purchase of parking tickets in connection with public transport tickets.</p>
<p>Target 17: 10 novel targeted business models (2 scenarios per LL) for integrated mobility services</p>	<p>New business models</p>	<p>Number of targeted business models for integrated mobility services</p>	<p>0</p>
<p>Target 19: Technical specifications and related roadmap for roaming services (one per LL) involving other cities and areas outside LLs, as a result of LL local workshops</p>	<p>Promotion of roaming Services</p>	<p>Technical and commercial specification for Roaming Services among MaaS schemes</p>	<p>0</p>

<p>Impact on competitiveness, attractiveness and quality of transport services</p>	<p>Quality of service</p>	<p>Perception of quality of service</p>	<p>Gothenburg LL plans to conduct surveys with end users in conjunction with pilots #1, #2 and #3 (see D4.2 for references about pilots). These will gauge user perceptions of quality, satisfaction, accessibility etc. before, during and after the pilot phase in order to examine the impact of each pilot.</p> <p>User surveys have previously been performed in conjunction with the Go:Smart/UbiGo field operational test. The results demonstrated, among other things, a high level of satisfaction and high perceptions of quality as a result of the MaaS service. A further study by Inter Metra in 2017 examined user readiness to adopt MaaS across Sweden. [3]</p>
<p>Promoting modal shift, transport efficiency and reduction of externalities generated by traffic</p>	<p>Transport Modal shift</p>	<p>% of trips made by each transport mode</p>	<p>Modal split:</p> <p>For the Gothenburg region:</p> <ul style="list-style-type: none"> • Walk: 15% • Bicycle: 8% • Public transport: 23% • Car: 53% • Other: 1% <p>For Gothenburg city area:</p> <ul style="list-style-type: none"> • Walk: 18% • Bicycle: 10% • Public transport: 34% • Car: 36% • Other: 1%

	Perceived accessibility	Perceived accessibility to transport services	This type of data is not measured in national or regional surveys. Perceived accessibility was examined using questionnaires as part of the Go:Smart/UbiGo pilot in 2012-14, showing that MaaS has positive impacts on perceptions of accessibility. [3]
	Total journey time	Average duration of journey from origin to destination	<p>For the Gothenburg region, mean average travel times are:</p> <ul style="list-style-type: none"> • Walk: 16mins • Bicycle: 19mins • Public transport: 42mins • Car: 25mins. <p>For the Gothenburg region, mean average travel distances are:</p> <ul style="list-style-type: none"> • Walk: 1.3km • Bicycle: 4.1km • Public transport: 17km • Car: 17km
Impact to standards and regulations	New standard or regulations	Impact to standards and regulations related to multimodality, integrated ticketing, etc.	Bob.samtrafiken.se - in operation via p-bolaget and other MaaS pilots. The BoB API is also applied in the existing ToGo app (VT) and all digital ticketing solutions
	Governance model	Impact to public-private regulations governing urban transport services	

4 PROCESS EVALUATION

As outlined in D5.1, the process evaluation is aimed to gain insights into drivers (factors of success) and barriers (impeding progress) during the implementation and validation of the IMOVE Living Labs, in order to point out which approaches and methods have been successful in terms of reaching the initial strategic and specific objectives.

In this report, the preliminary process evaluation has been carried out, by administrating questionnaires to both developers (the IMOVE partners in charge of developing the software enablers, the technical solutions and adding improved features to Living Lab MaaS platforms) and implementers (the Living Labs subjects in charge of organizational, operational and commercial activities for implementing the MaaS offers). The following subsections report the main outcomes of this initial process.

4.1 PROCESS EVALUATION FOR DEVELOPERS

For the purposes of assessing the work to be conducted in the context of WP2 (Software Enablers), an evaluation process has been set up. To this aim, a questionnaire has been created and circulated to which all the technical partners involved in the Software Enablers development process were invited to answer in order to include in the current document the baseline measurements and the initial evaluation with respect to the IMOVE development efforts. The questionnaire, rather than being generic, has been specialized according to IMOVE functionalities and the development peculiarities of the project (integration efforts, large-scale development, challenging and heterogeneous operating environments, etc.). The overall aim was to indicate to what extent the development of the software enablers is, and ensure in the very beginning of IMOVE development phase the following:

- Responsible persons/organizations have been identified for the development of every single component.
- The gathering of the end-user requirements has been translated into concrete system specifications. These specifications have been identified by all IMOVE developers as clear guidelines able to drive the development and integration of their component.
- Possible delays related to the development of a component will not pose any risk to the delivery of the integrated IMOVE platform according to the specified timeline.
- Issues related to the speed, robustness, stability, security, integration, and accuracy of results will be early identified so as to mitigate relative risks.
- The communication channels among the developers (remote calls, emails, etc.) are effective enough and as a result the overall consortium work is efficient and comprehensive despite the interdependencies in the functionality of the various IMOVE modules.
- There are no issues relevant to the deployment of the components.
- The prototypes of IMOVE software components function properly most of the time (i.e. not enough fatal errors or exceptions.)
- The design and development of every single component does not deviate from the completion of its intended task according to the DoA and WP2 guidelines.
- The collaboration between the technical partners will be facilitated through the detailed documentation of the internal APIs (Application Programming Interface). The aforementioned documentation will constitute a reference point for IMOVE integration activities.
- Most of the components deliver innovative services by offering features not found elsewhere.
- All IMOVE components are able to resist unlawful or malicious actions that may compromise the availability, authenticity, integrity and confidentiality of stored or transferred sensitive data as well as the services that are offered.

- Each institution holds deep expertise with respect to the technologies to be adopted for the development.

The target goal is to evaluate technical partners' productivity regarding the software development process, well before the verification of the project results, to improve effectiveness and efficiency on time, by eliminating risks and ensuring continuous quality. The results of the questionnaire will be communicated to the consortium through this deliverable, and relevant recommendations will be delivered to the developers so as to achieve product and services with the best quality guarantee. WP5 recognizes the fact that the productivity of IMOVE developers needs to be assessed before tackling its development, in order to carry out the project's goal and thus, improve efficiency and effectiveness. Thereafter, this questionnaire takes into account two main points of view: offer (ensure productivity of technical partners along IMOVE software development) and demand (ensure the most appropriate experts have been selected for the development purposes). It has to be noted that the recipients of this technical evaluation are the following:

- The Project Coordinator who will mitigate risks relevant to development efforts depending on the findings of this assessment process. Recommendations for process improvements in the development phase will be communicated in this case.
- IMOVE developers who will keep in touch with the managers, the coordinator WP2 leader so as to reconsider development decisions if needed (adopted technologies, architectural decisions, etc.)
- IMOVE managers who will be responsible for keeping up to date this assessment in order to timely recognize potential discrepancies and deviations with respect to the development efforts of the relevant institutions.
- WP5 leader who is responsible for designing the evaluation plan steering the impact assessment activities and also communicating the evaluation results to the whole consortium.

At this stage of the IMOVE project development phase, **SOFTECO** is responsible for the design and development of the **B2B API (Open API) enabler**, the **Notification Manager** and the **Incentive and Gamification manager**, **Mosaic** is responsible for the design and development of the **Preference Manager** and **Mobility Tracker**, **URBI** is working on the design and development of the **Identity Manager**, the **User Tariffs Manager** and the **Preferences Manager**, **CVUT** is responsible for the development of two SW enablers, **Mobility Organizer** and **Price Manager** and **ICCS** is responsible for the design and development of the **Roaming Manager**. All partners will work together for the integration of all software enablers with the whole IMOVE platform. Therefore, in line with the guidelines provided under D2.2 "Initial system architecture and specification", pertinent Application Programming Interfaces (APIs) are going to be developed for the Software Enablers to ensure the interconnection of multiple MaaS operators towards the realization of inter-roaming and cross-border roaming services.

As far as the requirements for development are concerned all partners agreed that all requirements that derived from the User Scenarios during the WP technical meetings and were outlined in D2.1 are sufficient and clear enough for the development. If anything was not clear in this phase, it has been easily clarified via online calls. Additional requirements and iterative validation from the Living Labs is also expected. Living Labs feedback would prove beneficial for the translation of specific requirements into concrete technical specifications concerning mostly Roaming use cases (roaming agreements, roaming transactions, etc.).

The development of the first batch of software enablers started with slight delay and some deviation from the original plan mostly because of shifts in the schedule of previous tasks, need for completion of deliverables, interdependencies of modules and rather poor baseline information from the Living Labs. The targeted delivery time seems not to be affected much though. The development of the Roaming Manager has not yet started, but this is in accordance with the timeline of WP2 which has prioritized the development of other Software Enablers towards the first deployment and Roaming Manager is part of the second batch to be delivered.

According to the design and estimations, efforts will have to be given for ensuring data privacy and security, especially in relation to the protection of personal data to be shared across the MaaS actors. Furthermore, due to the modularity in design (because of the numerous software enablers) some issues may be detected with respect to integration with the other IMOVE components. The main pain point is to figure out a development model that fits nicely between IMOVE requirements and the existing infrastructure. For example, **Open API** enabler is expected to communicate with several other enablers, so the integration/maintenance phase will be critical. **Preference Manager** and **Mobility Tracker** are critical at privacy level so specific security measures will be implemented to be compliant with the GDPR. For the **Mobility Tracker**, a potential risk could be not to have any data source with information of the geocoordinates of the users. A way to mitigate it could be to create a specific application to be used to report the user coordinates. Both the **Mobility Organizer** and **Price Manager** are components that are tied to a specific deployment area (Living Labs at the first stage) to some extent. This means that we first need to collect various information from the area such as the list of transport providers present, applications they maintain, APIs etc. Once we have all this information, we need to adjust parts of the code accordingly. The only problem encountered so far are the delays caused by gathering this information.

Developers found different mechanisms effective for stimulating and facilitating development. The most effective but also the most difficult in terms of price and time were found to be the physical meetings. Remote group calls including one-to-one conversations on Skype were also found to be an effective way to quickly tackle a specific problem/issue. Other development facilitating ways include email exchanges mostly for the architecture and design phase, technical documentations, blogs and websites for the development phase.

All partners agreed that internal and inter WP technical meetings have been a useful way to define the scope and interactions of the different enablers. Feedback from WP technical teleconferences and emails were also found useful to steer development.

Limitations within the components developed included the level of personal data the user will give access to. For example, as said before, the **Mobility Tracker** is dependent on the information of the user geocoordinates. Another limitation URBI faced was the missing of a partnership with a taxi provider which therefore made them unable to provide that functionality. The roaming potential in the IMOVE project highly depends on the limitation of the Living Lab roaming use cases (agreed clearings for exchanged services, roaming contracts, etc.).

At the time being, none of the developers had any criticisms to make for the development process of the components. Additional feedback may be provided at a later stage.

Following this, the developers were asked to provide the views they had on the development of their components. Naturally, it is difficult to nail a project specification and foresee technical problems before the actual development starts. From a documentation/ specification perspective, many things are due revision once the implementation will be completed, to account for the specific problems discovered and raised during the actual implementation. To support the concrete implementation of the software enablers, feedback from the Living Labs with respect to detailed roaming Business Models to be supported by the technology (details of roaming agreements, agreed clearings) has to be provided as well. What makes the IMOVE software enablers powerful is the combination of their capabilities. This means that the development of a certain component depends highly on external functionalities provided by other IMOVE software enablers or made available by underlying MaaS platforms. Some enablers have evident synergies between them. The enablers are developed as standalone entities that might prove quite useful, not only in the environment of living labs (when combined), but also beyond. Some of them might even have further uses in the research process.

As far as the ease of deployment of the components is concerned, the process is supposed to be designed to minimize the deployment effort. Components are well-defined and can be divided into separate software

sub-components that are small enough. Developers will use a very agile scalable way to deploy the components as micro-services or docker components. Automation of the build and deploy steps will also be used so that the process boils down to a click on the build server. For the components that have not yet started the development phase, the early identification and the enclosing of the dependencies (hardware requirements, software libraries, etc.) and the network configuration from the early stages, is believed to ease the deployment procedure.

Software Enablers are not expected to freeze and crash in general. At this time there is no concrete estimation for all the components regarding these matters. Components that are in a decent development level seem not to freeze nor crash. At most they return an error. However, information about this will be available at a later stage, after a significant testing and running time frame.

The components are expected to meet requirements identified in early stages according to the user requirements specified in D2.1. An iterative approach for their improvement will be adopted, according to which the initial simplified implementation will progressively gain more complexity and a broader feature set in parallel with the development of the other software enablers and the continuous feedback from the Living Labs. Their ability to rapidly adapt to the changing needs of both the other software enablers and the Living Lab requirements throughout the course of the project, will ensure the success of the software components in terms of performing the intended tasks.

The goal for all components is to perform the required tasks. Nonetheless, in case of deviations from user expectations or requirements, adaptations and refinements will take place in line with WP2 guidelines.

The existing accurate documentation available for the developments of the software enablers is useful as a general direction and improves the developer experience. The details are left to the implementer. As soon as the process completes, developers will provide complete technical documentation along with their components, with particular focus on interoperation with external systems/components.

All components that are being developed under the scope of the IMOVE project are unique and distinguishable from other software modules. Each component has its own well-defined scope and definition and implements a specific functionality. Each one can be deployed and called independently, however some complex functions are performed with data exchanges in cooperation with other components. To the best of our knowledge there are currently no similar solutions tailored to MaaS operators.

IMOVE aims to pave the way for a roaming capability for users across various MaaS schemes that are implemented within different geographical contexts. Components developed for such reason, have novel features. Each component is designed to provide unmatched functionalities within IMOVE, some of these however, may be already accomplished by other software system available in some MaaS platforms and/or on the ICT market.

The performance of the components still cannot be measured because the development has not yet completed. However, their logic neither involves intensive processing in terms of algorithmic complexity, nor are dependent on a complex database design. In any case, in order to boost performance and be proactive, the software enablers will be optimized to minimize network trips and make use of efficient algorithms and data structures. After all performance will be assessed and tuned while running on the Living Labs.

Data security is one of the most important aspects in all enablers. Data will be secured according to the guidelines of the Ethics Review Board (ERB). Thereafter, security measures will be incorporated in order to restrict access to users eligible for handling those data. Proper authentication and authorization mechanisms are adopted, along with transport level security for over the Internet data transfers together with data encryption and the APIs will be secured by using widely accepted API security protocols. All involved parties assured that data will be secure and well protected.

Most of the components of the first batch to be delivered are in development phase and at this time they are substantially more than 50% done. Each application deployment will be a selected and self-consistent set of

components that satisfies the relevant Living Lab requirements wishing to develop and test sustainable MaaS business models.

Technologies/ frameworks/ environments determined for the implementation of the software enablers include Ubuntu OS, MySQL, Django, Django Rest Framework, Apache HTTP server. All involved parties, found the technologies for development adopted compliant with their organization's expertise as all of them have a strong background in ICT and software development, and a backlog of projects on the development model, the technologies and development tools adopted within IMOVE.

All parties, despite their previous experience and their organization's expertise on the project's adopted technologies, had to adapt to them. Some partners have made upfront efforts to refine the required skills so they required negligible time. Others found the required time difficult to be estimated and evaluated as the technological adaptation is part of the development process for Innovation projects like this.

For the choice of the development language and tools, a state of the art review has been performed. Effort is being made in order to maximize the usefulness of the tools (workflow optimization, burden reduction, etc.). Moreover, a level of conformity is achieved through self-training and documentation before the development phase and the utilization of the technologies. An important factor was considered to be the agile prototyping approach. So that, starting from a clean project, they could provide new fully functional and incremental versions on each iteration. Then those versions can be validated. Necessary changes are detected early and incorporated in next iterations. As a first step the developers started with the identification of tasks that required brand-new development and tasks that could be built on top of their existing infrastructure, if any. A fairly regular test-driven development has since begun and is approaching completion.

4.2 PROCESS EVALUATION FOR IMPLEMENTERS

For the purposes of assessing the work carried out by Living Labs (mainly in WP4, with the support of WP1 for business modelling) the process evaluation questionnaires have been administrated to Living Lab leaders.

The main outcomes are hereafter reported:

- The involvement of Living Lab stakeholders is judged neutral with the exception of Gothenburg where this is considered very positive and could be assumed as best case in the project to be emulated.
- The support of IMOVE for stimulating the engagement process is not considered sufficient so far and appropriate actions should be taken for facing this issue.
- With regards to specific activities carried out with local stakeholders, Torino mentions the Ideathon, organised with UITP, for raising innovative ideas related to MaaS; Gothenburg mentions the generic relations with all mobility service providers, Manchester had a successful workshop for stakeholders, held in Summer.
- With regards to main technical, operational or commercial issues that are impacting on the implementation at site level, the following responses were provided:
 - Shared mobility:
 - Gothenburg has one major supplier of carsharing services in Sweden (Sunfleet), which limits the other options available. DriveNow and Car2Go previously provided free-floating services in Sweden (Stockholm) but have not shut down their Swedish operations. **This problem has been rated as critical for the success of the Living Lab.**
 - Berlin refers that taxi integration is missing, and it was not possible to find any provider willing to collaborate on the project. Commercially, the setting of

Commercial Agreements with the chosen potential partners have resulted to be difficult under various points of view, specifically: legislative and business wise. **This problem has been rated as moderately relevant for the success of the Living Lab.**

- Torino already set commercial agreements with one carsharing provider but the most relevant free-floating operators are still reluctant because they are afraid to lose market shares.
 - The bike sharing operator has recently left Manchester (this happened in several other EU cities). **This problem has been rated as moderately relevant for the success of the Living Lab.**
 - Static Public Transport data:
 - No issues detected
 - PT fare data and services
 - In Gothenburg Västtrafik provides a limited and fixed ticket offer for the pilots. It is a potential issue with different fares for different geographical zones. **This problem has been rated as critical for the success of the Living Lab.**
 - Torino will interface the service provided by the public transport company GTT. **This collaboration has been rated as serious for the success of the Living Lab.**
 - In Manchester digital bus fare data are not readily available for all operators. **This problem has been rated as moderately relevant for the success of the Living Lab..**
 - Real-time PT data and services
 - No issues detected
 - On-demand transport data and services
 - In Gothenburg 2 out of 3 pilots will integrate Taxis and Sunfleet (carsharing provider). There is a direct discussion between re-sellers and transport operators. Sunfleet wants to offer its services to third parties but there are issues in terms of responsibilities (legal problems). Also Västtrafik has on-demand transport services but it will not be integrated in the pilot because it is addressed to the countryside or for disabled people, therefore is not suitable for the addressed target groups.
 - Not applicable in the other Living Labs
 - Traffic data and services/ Incident data and services
 - In Gothenburg Västtrafik will provide such info with an API.
 - Not applicable in the other Living Labs
 - Mapping data and services
 - No issues detected
 - Parking data and services
 - Västtrafik provides information about commuter parking as open data
 - Not applicable in the other Living Labs
- In terms of **governance or political issues** able to impact on the implementation of the Living Lab in either a positive or negative way, the responses refer to:
 - change in policy or change in political leadership in Torino, also because the commercial relationships between the PT company and the MaaS operators were not so smooth and the municipality had to provide support.
 - TfGM in Manchester has limited influence on multi-modal products, which are retailed by a third party (GMTL), including tickets. This is an issue that should be monitored because of potential impacts in the Living Lab.
- In terms of **risk detection**, dedicated questions were asked about various potential issues:
 - Support from external entities (partners or stakeholders)

CONCLUSIONS

The second deliverable of WP5 serves as an assessment of preparatory project activities and, apart from recording initial measurements that will be used in before-after evaluations, it raises important points to project partners.

The complexity of developing in parallel both technical features and business offers is showing some criticalities that should be taken into account. From a technical point of view, requirements were considered clear enough but the integration of tasks with external MaaS platforms not completely deployed could generate problems that are not predictable so far; therefore, appropriate monitoring measures should be carried out for timely identifying any issue. From an operational point of view there are some critical situations with regards to commercial agreements, due to the reluctance of some transport providers in playing in a market whose future evolution is unclear yet. Besides this consideration, Living Labs stated to have not adequately been supported by the project in user engagement strategies and this issue will be tackled in the next period by identifying corrective actions.

The next period will be dedicated to addressing these initial indications and to keep monitoring the implementation of Living Labs, together with WP4 and the related data collection.

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