SUNSET

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The SUNSET project

SUNSET (http://www.sunset-project.eu) is a three-year research & development project part of the European Commission's Seventh Framework programme Smart Cities & Sustainability under DG Connect (http://ec.europa.eu/dgs/connect/en/content/smart-cities). SUNSET started in February 2011 and has ended February 2014.

SUNSET develops and evaluates a set of innovative services that use Smartphone technology, social networks and incentives to encourage people to travel more sustainably in urban environments. The project's objective is to increase personal mobility and at the same time reduce congestion, increase safety, and protect the environment.

The SUNSET project uses a human-centred approach to achieve its objectives stimulating people to change their individual travelling behaviour. To influence behaviour, we developed and exploited a Smartphone application named tripzoom featuring challenges and rewards to move smarter. Moreover, we tailor and personalise these incentives by means of automatically measuring actual travel behaviour of the Smartphone user.. This is a personalised, multimodal coaching approach to traffic and mobility management, based on rewarding good behaviour.

SUNSET is an initiative of a consortium of nine public and private partners from four different European countries with a total budget of 4.1 million euro. SUNSET combines technical with social research creating new services for sustainable travel and evaluation of these services in real life settings of the cities Enschede (NL), Gothenburg (SE) and Leeds (UK).

Summary

The aim of this deliverable is to report on the Living Lab operation of the SUNSET Living Lab Leeds. At several points during the project users (drawn from the travelling public) were involved; first in the design process, later in using tripzoom (the service developed within the SUNSET project) and finally in evaluating social media functions and app services like tripzoom. The Leeds Living Lab was a 'Broad Spectrum Lab', covering automatic data collection, directed group discussions and structured, supervised questionnaires. In this sense it was distinct but complementary to the other two Living Labs (Enschede and Gothenburg).

This deliverable forms one of three Living Lab reports from the project, the others reporting on the Enschede Living Lab (D7.2) and Gothenburg Living Lab (D7.4). The evaluation of the Living Lab outcomes is reported in terms of operational success and effectiveness of incentives in the evaluation deliverable (D7.5).

The recruitment efforts that took place in Leeds resulted in 112 Living Lab participants overall, who took part in various experiments from co-design functions and trialling the tripzoom software to focus groups and structured questionnaires. Of these, 72 users took part in focus groups and completed related questionnaires which were designed to explore a wider range of features of the SUNSET concept than were possible in the other Living Labs: future uses, purposes and particularly travel behaviour modification. Questions were also asked to explore the boundaries – that is, the levels of acceptance of different functionalities around the social media and location-based services and incentives, and the unintended consequences both negative and positive some of which informed the understanding of boundaries. The design and operation of the survey work and Living Lab preparation in the project as a whole resulted in a Management Model for Living Lab Operation, as well as a Design Format for future experiments.

Based on the interaction with users, many lessons are learnt from the Living Lab in Leeds and these are summarised in a strengths-weaknesses-opportunities-threats table below. One of the most important concerned communications and the need for a clear message for the user of "what's in it for me". This turned out to be difficult within the research scope, as many features were incorporated in the software in order to discover what users liked best. Retention activities were in place, but even so the early phase of the Living Lab was faced with drop outs and from this, experience was gained covering the spectrum of recruitment, conversion and retention rates. However, other users appreciated the alpha status of the app and recognised the great potential in the concept of SUNSET.

The Leeds Living Lab discovered the role of monetary compensation to participants for inconvenience and the various value-for-money aspects of using either social media or a professional recruiter. A small reward to users seemed to be important in their decision to finally take part. Whilst the use of social media for recruitment was convenient and dynamic, the conversion rate raised some questions around value for money overall. The use of a professional recruiter to obtain a profiled cohort required a solid financial commitment; it proved extremely cost-effective however in obtaining the required sample in terms of volume and profile.

During the Living Lab Preparations, a valuable data protection and management protocol was developed which created a clear story to the user, and good guidelines for the Living Lab Operation. In the light of the ongoing discussion regarding collection of personal data, this framework gives a solid basis for future projects registering personal location traces.

The increasing role of pervasive technologies and ICT in transport is highlighting the need for a new set of skills for staff at various levels in the sector. The research has identified that a particular set of skills are needed for a Living Lab Coordinator to design, implement and assess a successful LL.

The Living Lab evaluation (D7.5) demonstrates that all Living Labs contributed in proving the concept. That deliverable, together with D8.2 on exploitation, includes an outlook for systems like SUNSET. In the Leeds case, this has already taken a next step in the generation of a Technology Strategy Board funded feasibility study and a new £6.5m 'Big Data' Centre at the University of Leeds.

Strengths	Weaknesses
• A 'Living Lab' approach can generate large volume primary user data either automatically or semi-automatically, in contrast to some conventional research methods	• The SUNSET project had a number of research objectives whilst tripzoom contains many functions. We noted the success of other 'single focus' applications and recommend that model for future software
• Proof-of-concept that there are users willing to share their mobility patterns has been demonstrated.	• As user-testing is an important part of the design and implementation loop (and a strong cohort of testers is highly desirable), the expense of user reimbursement should be anticipated in future labs.
• The technical feasibility of software such as Tripzoom within a representative large city (Leeds), rather than in a 'supercity' (e.g. London) has been demonstrated .	• Funds are also needed to engage in research involving commercial social media. The level of financial draw involved may not be desirable or available to future researchers.
• A strong ethical framework within which similar experiments of this type could be conducted in future has been developed.	• Due to the innovative nature of the process, few templates and established protocols were in place at the outset of the research for robust and ethical data protection and management processes.
• The increasing role of pervasive technologies and ICT in transport is highlighting the need for a new set of skills for staff at various levels in the sector.	• Establishing provenance for a new piece of software through association with established stakeholders and organisations may be necessary to build trust with users.
• Social networking has been articulated through: tripzoom features, recruitment methods, research methods and dissemination processes. The boundaries and capabilities of media such as Facebook have been explored.	• In order to ensure all steps had been taken to safeguard individuals a multistage registration process was used. A one-step seamless registration procedure would have been highly desirable from the user-experience perspective.
• The dynamic nature of the qualitative tripzoom related research has highlighted the need to anticipate and be prepared for various pathways through the related discourse with stakeholders.	• The definition of user groups (through the City Dashboard) is an important task and ideally based on accurate travel information Collecting this information at the outset creates an addition burden (e.g. at registration) for the user.
• With dynamic software that supports direct communication with users, there is a need for fast and accurate communication and a high level of service is essential for success.	• In line with previous research in the broader social media context, the Leeds LL found that the time requirement for engagement with users by the LL Co-ordinator is significant
• The tripzoom implementation, communication process and assessment needs have contributed to the development of various LLC tools, which may act as templates for others.	• Inevitably with a prototype, technical difficulties arise and a number became apparent with tripzoom. However these technical difficulties are
• A simultaneous and collaborative launch of three LL has illustrated how 'cross-border' cooperation and management of such LLs is possible within a single system overall.	
• It was found that a small but immediate monetary	

compensation for inconvenience plays a role in successfully recruiting participants to the LL. • The operational phases of the Leeds LL have demonstrated the effectiveness and value for money in working with a professional recruiter to obtain a cohort with a specific profile. • The mixed methods approach taken in the operational stages of the Leeds LL generated a database of mixed quantitative and qualitative outputs, which was valuable in understanding of wider factors for success for a tripzoom type application. • Any future business model for a tripzoom type scheme is likely to include a range of stakeholders. The research overall has created awareness and knowledge of the perspectives, priorities, needs and restrictions of a range of stakeholders	potentially agenda setting future research • With some commercial or near market products a highly desirable 'viral' effect has been seen. This was not the case with tripzoom, but with an ethical multistage registration process it may not have been expected.
Opportunities	**Threats**
• The registration process as a whole is an area with potential, particularly if the balance between privacy/security/ethics and positive user experience can be resolved. • Providing accurate information to users e.g. about real time traffic conditions or trip CO_2 emissions could further enhanced the system • User expectations can be managed well where objectives are clear and communication protocols/content are strong and nuanced from the outset. Further developments to the reward policy and ensuring frequent, engaging communication would facilitate this • As the research basis becomes established, the pool of experience in designing, collating and managing social media related material should expand. Social media research should become increasingly resource efficient. • Where feasible to offer high levels of service (e.g. 24/7 helpdesk for technical support, this is likely to increase user trust and participation, resulting in higher retention and improved data quality over time. • Opportunities to share some types of costs and raise the profile of LL experiments can arise through co-ordinated actions with other LLC and local stakeholders • Whilst bespoke data protection and management processes were developed in this project, the opportunity exists to further develop these to transferable processes with wider benefit.	• The timing of a LL should be carefully planned but incorporate sufficient flexibility to deal with the number of uncertainties and the iterative design loop. • Social media may prove a resource intensive process due to relatively low conversion rates. Progress monitoring and dynamic responses can serve to mitigate some of these costs. • In line with other social media research outcomes, an important finding is the need for constant monitoring to avoid negative publicity. The first user impression counts disproportionally to the whole. • User participation and retention may be impacted by the level of wider stakeholder engagement e.g. third parties. These lend credibility and provenance to the initiative. • Technical problems arising with prototype software but remaining unresolved during a LL have an impact on user experience and participation. This may be addressed by planning further cycles of re-design into the lab implementation overall. • A stable and reliable GPS tracking system is required to be able to provide accurate data, properly targeted challenges and to avoid discrepancies. The research overall has identifying significant (and less significant issues) of this type for the forward agenda.

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V0.2	14-11-2013	Chapters 2, 3, 4 drafts
V0.3	22-11-2013	Chapters 4 and 5 drafts
V0.4	10-12-2013	User feedback and background material input
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Glossary

BOS: Bristol On-line Survey

ESQ: Experience Sampling Question

FP7:   FP7 is the 7th Framework Programme of the European Commission which funded research during 2007-2013

HEIs: Higher Education Institutions

ICT: ICT refers to Information and Communication Technology, which formed a specific research area within FP7.

LCC: Leeds City Council

LLC: Living Lab Co-ordinator

NHS: National Health Service

TSH: Transport Systems Hub

UoL: University of Leeds

WP#:   Work Package

WYTPN: West Yorkshire Travel Plan Network

1. Introduction

The Leeds Living Lab report presents management aspects of the Living Lab in Leeds. The focus in the deliverable is on the user process (recruitment and interaction) and the management of the experiments performed in the Leeds Living Lab. All operational aspects are covered in the document, whereas the evaluation of outputs, including propensity for behavioural change is documented in D7.5: Living Lab Evaluation.

1.1 Goals

The goals of this deliverable are to:
 - Document the recruitment actions taken in the Leeds Living Lab;
 - Report the lessons learnt from the recruitment of users;
 - Report on the experiments which took place in the Living Lab;
 - Give insights on the strategies for retention of the users;
 - Give structured insights on the 'do's and don'ts' of running a Living Lab;
 - Present a management model for Living Lab operations.

The work in this deliverable is related to the following other parts of the SUNSET project:
 - Deliverable D7.1 – Within D7.1 the plan for the Living Lab was given a preliminary specification and other aspects of the SUNSET work were brought together towards the Living Lab operation;
 - Workpackage WP3 – The work on different types of incentives that took place in WP2 formed the basis on which the experiments were built;
 - Workpackages WP2, WP4, WP5 – The technical system developed in those workpackages forms the basis for the work which could be done in the Living Lab;
 - Workplackage WP6 – The evaluation framework designed within WP6 formed the basis for the evaluation of the experiments that were carried out in the Living Lab;
 - Deliverables D7.2 and D7.4 – This deliverable is one of three Living Lab reports which also comprise the report from the main Living Lab in Enschede (D7.2) and the other reference in Gothenburg (D7.4). These report research that ran in parallel with the work in Leeds;
 - Deliverable D7.5 – The evaluation of the work in the Living Labs towards the SUNSET goals has been reported in D7.5 for all Living Labs.

1.2 Main Results and Innovations

One of the key aspects of the success of SUNSET is the use of Living Labs to collect various types of data from members of the travelling public. This deliverable describes the experiences of the Leeds Living Lab, including interaction with and recruitment of users, as well as the experiences of the Living Lab Co-ordinator

Table 1-1: Contributions of this deliverable to SUNSET innovations.

SUNSET innovations	Contribution of this deliverable
Social mobility services that motivate people to travel more sustainably in urban areas	In the Living Labs the SUNSET services are put to the test in a real world situation. This deliverable reports on the Living Lab execution and deployment of the SUNSET services to end-users.
Intelligent distribution of incentives (rewards) to balance system and personal goals	N/A
Algorithms for calculating personal mobility patterns using info from mobile and infrastructure sensors	N/A
Evaluation methodologies and impact analysis based on living lab evaluations	The Living Lab's operation is described in this deliverable. In the planning of activities a close link is ensured with the evaluation framework and the experimental work.

1.3 Document Structure

Whilst this deliverable is intended to be coherent as a stand-alone document, there are strong ties with the deliverables of the Enschede (D7.2) and Gothenburg (D7.4) Living Labs, as well as deliverable D7.5: Evaluation of Living Labs. In general, all operational and management aspects are covered in this document, whilst all experimental results are documented in D7.5. Figure 1-1 shows the links between the three Living Lab reports.
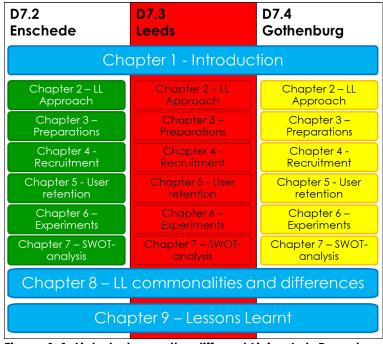

Figure 1-1: Links between the different Living Lab Reports

All three reports start with common chapters giving an introduction and approach. They also all end with a chapter providing commonalities and differences between the Living Labs. On the different Living Lab topics, each Living Lab describes their own local variations, except for some

overview paragraphs on the tripzoom[1] system. There are strong ties between the different Living Labs, where a shared discussion led to different choices being made in different labs. On one hand, the successes of one lab have been used to inform processes in the others as much as possible. On the other, different approaches have been used in different labs in order to test as many aspects as possible and also as a means of risk avoidance.

This document describes the operation of the Living Lab in Leeds, starting with the high level choices made in the Living Lab Approach (Chapter 2). The rest of the document describes the different stages in operation: preparation activities (Chapter 3), recruitment actions (Chapter 4) and retention strategies (Chapter 5). Chapter 6 describes the experimental work implemented in this Living Lab and how the Leeds Living Lab evolved into a 'Broad Spectrum Lab' rather than focusing on the tripzoom software alone. Chapter 7 presents an overall conclusion using the structure of a SWOT-analysis. In chapter 8 the overall commonalities and differences between the three SUNSET Living Labs are presented. Chapter 9 presents the main lessons during Living Lab operation, and gives hints and suggestions on how to run future Living Labs.

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[1] tripzoom is the brand name of the mobile application and its related systems, as they are used in the SUNSET Living Labs.

2. Living Lab approach

Employing users' smartphones to conduct research experiments under real life conditions has been a new and developing domain prior to the launch of SUNSET. These devices offer ubiquitous, unobtrusive and cost-effective access to user data which previously was not possible due to a range of reasons, for example technological limitations, high costs or user fatigue (Raento et al, 2009). Contemporary technological developments have allowed the evolution of research methods such as the Day Reconstruction Method (Kahneman et al, 2004) which are currently being facilitated through smartphone use and which can be applied in controlled research environments, namely Living Labs. Rigorous design, development, implementation and analysis of the Living Lab experiences form indispensable components of such an approach, in order to bring correlations and causalities to light and leading to the identification of future challenges (Gustarini et al, 2013). The use of a Living Lab approach within SUNSET has been described in previous deliverables (e.g. D1.1 and D7.1), so a brief summary of the benefits of using this research method are offered here:

- *"Co-creation in users' real-world context results in mobile artifacts with **higher expectation-experience** fit than artifacts that were co-created in laboratory-like settings*
- *Co-creation in users' real-world context results in mobile artifacts with **higher acceptance value in terms of usage behavior** than artifacts that were co-created in laboratory-like settings*
- *Co-creation in users' real-world context results in mobile artifacts with **higher acceptance value in terms of fulfilling user needs** than artifacts that were co-created in laboratory-like settings*
- *Co-creation in users' real-world context results in mobile artifacts with **higher business value in terms of economic success** fit than artifacts that were co-created in laboratory-like settings*
- *Co-creation in users' real-world context results in mobile artifacts with **higher business value in terms of user retention** fit than artifacts that were co-created in laboratory-like settings"*

(Pergler and Tarcus, 2013)

These issues inform the contents of this deliverable, starting with chapter 2 here, which focuses on the approach taken in the SUNSET Living Labs. It starts with a structured planning of the Living Lab, described design choices made and presents the management modal for living lab operation. The detailed activities in the different stages for the Leeds Living Lab are described next. Lessons learnt and aspects of good practice are presented at the end of the chapter.

2.1 Living Lab Stages

Figure 2-1 shows the different stages of the Living Labs in time. The interaction with participants is divided into three successive stages:

- Preparation stage
- Pre-operation stage
- Operation stage

Figure 2-1: Stages of participant interaction

Preparation
During the preparation stage, participants were involved in order to provide user inputs to the design process. These design preparations are outlined in the deliverables arising from other work packages and are reflected in the final tripzoom software. The Living Lab partners (Enschede, Gothenburg and Leeds) contributed towards improvement of localisation in software design aspects, in the design of the LIVING LAB and initiated recruitment plans and processes. During this stage, SUNSET was used as a project name in communications with the participants.

Pre-operation
The pre-operation stage involved testing the tripzoom system. Technical development of the software took place in several releases and for each the Living Lab partners carried out an evaluation from a user's perspective. This included both the travellers role and the Living Lab Co-ordinator role. In the later releases, members of the public become the users and took part in this evaluation.

Alongside system preparation, preparation for other aspects also took place. Examples include: submission to the app stores[2], development of privacy regulations and other good practices around privacy and establishing the organisation for operation of the lab.

Operation
During the operation stage the app was introduced to a broader audience and in the different Living Labs, different aspects of the SUNSET concept were tested. This was undertaken using both experiments in a Living Lab setting and partially by designing Focus Groups for those parts of the concept which were not integrated in the tripzoom system.

2.2 Design of the Living Lab

During the operational stage, the aim was to establish proof of concept for the total SUNSET system. In order to achieve this, a mixed approach was used in the format of the Living Labs.

Living Lab with Experiments
The first choice made was to work with a Living Lab that involved members of the travelling public. The app was made available for everyone who had been recruited to download from the app store. A set of targeted experiments were designed with a shorter time line rather than a

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[2] The app is developed for iOS and Android. The term app store is used as a general term for both the Apple iTunes App Store as well as Google Play.

single extended experiment. With each of the experiments, different aspects of the SUNSET concept were evaluated.

Integrated approach

With the choices made within the Operational Stage, an integrated approach was taken overall. This is an alternative schema to the approach whereby there is a largely discrete software development stage followed by an independent testing and operational stage. In SUNSET, operations were strongly interlinked with the technical development, the SUNSET goals and the evaluation framework. This was intended to draw as much user input as possible into the design and operation, resulting in the most effective experiments.

Adaptive planning

As with all new software, there was a fragile basis of trust with the users, hence an adaptive planning approach was used. This ensured that lessons learned in one Lab could quickly be addressed in the others. Also, based on local circumstances, risk aversion strategies could be applied as soon as possible.

Mixed recruitment strategies

For the Enschede and Leeds Living Labs, a Living Lab was set up where recruitment was an ongoing action during the entire Operational Phase. In contrast, for the Gothenburg Living Lab specific recruitment actions were taken per experiment.

Mixed experiments

At the operational stage, different ways to involve users were used to explore the broadness of the SUNSET concept. In Enschede and Gothenburg, experiments were carried out with a user base using the tripzoom application. In Leeds, it was decided to explore a wider set of issues that were important to the longer term future of a tripzoom application, for which focus groups and survey methods were the most suitable research tools.

2.3 Management Model for Living Lab Operation

In the operation stage, the intention was that several experiments would be organized following the Management Model for Living Lab operations, which was developed based on the planning in D7.1 (see Figure 2-2). The model consists of three sequential phases through which the experiments are performed. In the Leeds Living Lab, implementation of Phase 2 followed a different route in order to explore wider issues for users.
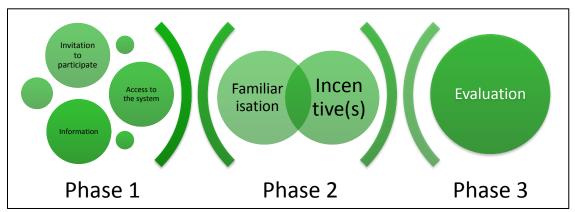

Figure 2-2: SUNSET Living Lab Operation Model for each experiment

Phase 1 makes the step from unknown people to tripzoom users. The main steps are recruiting users, informing users about the project, and getting users involved in the project. Chapter 4 describes the actions taken in this phase.

Phase 2 is the experimental phase. It starts with familiarisation where users use the tripzoom app without any other intervention from the project. This way, they have the chance to explore the different functionalities of the system and build up a mobility profile demonstrating their 'regular' behaviour.

During this first activity the Living Lab co-ordinator monitors the activities using a strategy designed to retain users in the living lab and to prevent participants to drop out (see chapter 5 on retention). The Living Lab Coordinator also designs the incentives to be offered during the second activity. The mobility profile is used to determine which user should get the incentive. When users are invited to join a second experiment, they immediately start with the experiment. In that case, phase 1 and the familiarisation is not repeated. The different experiments carried out are described in chapter 6.

In order to align the experiments with all different stakes (user preferences, SUNSET goals, traffic system goals), a general format was used for the experimental design (Table 2-1). This format was also used to align the design of experiments between the Living Lab. It interfaces the high level ambitions of the experiment with the context in which the experiments take place, leading to the detailing of different parameters.

Table 2-1: Experimental design format

Research Question					
What do we target in the experiment?		Do we reward behaviour or do we stimulate change?		What is the research question?	
Context					
SUNSET Innovation	SUNSET High level goals	The System	The Data	The Users	The Living Lab
Experiment					
Situation without treatment	Situation with treatment	Target Group	Incentive	Scope	Repeat Pattern

In the Leeds Living Lab, Phases 2 and 3 take an alternative route and involved exploratory work using focus groups and a questionnaire survey. These provided an evaluation of these kinds of functionalities and services within the wider commercial domain based on the kinds of apps and services that are currently available.

As is described in the Living Lab Evaluation Deliverable (D7.5), the evaluation of the data arising from the Enschede and Gothenburg LIVING LAB also involves analysis of questionnaire results arising from both a pre- and a post-questionnaire. Trip data is used to back up any reported behaviour in the questionnaires. Experiences from operating the Living Lab were also collected and reviewed in order to synthesis a set of recommendations on the operation of a Living Lab operation.

2.4 Leeds Living Lab planning

The preparation stage (Figure 2-3) included interaction with the user at a point where the actual application was not yet ready for trial use. The studies in this stage focused on potential system functionalities and served as inputs to the system development.
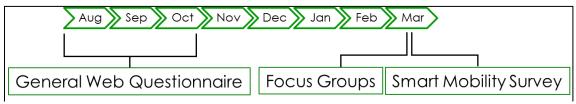

Figure 2-3: Preparation stage (August 2011 – March 2012)

The pre-operation stage (Figure 2-4) involved different studies where the application was the central field of study. During this stage, there was an incremental process from a pre-alpha version towards a version which could be used in a Living Lab setting. The stage ended with the Technical Trial which focused on data quality. During this stage, the submission to the Apple App Store and the Google Play Market was made.
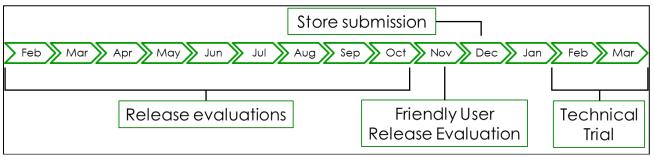

Figure 2-4: Pre-operation stage (February 2012 – March 2013)

After the pre-operation stage was finished, the operational stage started (Figure 2-5). During the Living Lab there was continuous testing of the tripzoom app with users. At the end of the Operational stage, a series of questionnaires and focus groups were carried out and at this stage the Leeds Living Lab expanded to form a 'Broad Spectrum' Lab. It was broad spectrum in terms of the scope of the technical issues examined with the members of the travelling public who formed the experimental cohort. This is discussed in more detail in Chapter 6.
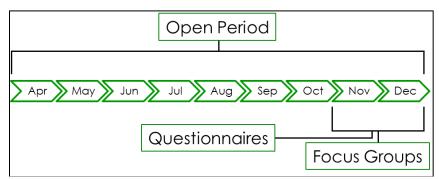

Figure 2-5: Operation stage (April 2013 – December 2013)

The table below shows the types of evaluation that took place within the Living Lab. The following chapters are formatted around these phases to describe recruitment and tests.

Table 2-2: Evaluations in the Leeds Living Lab

	Month	Experiment name	Type of experiment	Participants	Deliverable reporting results
Preparation	August / November 2011	General Web Questionnaire	Web based questionnaire	Travelling public as users	D1.1
	March 2012	Smart Mobility Survey	Web based questionnaire	Travelling public as users	D3.3
	March 2012	Focus groups	Focus groups	Subset of Smart Mobility Survey	D3.3
Pre-operation	February – October 2012	Release 1-6 evaluation	Heuristic evaluation, cognitive walkthrough	Project internal	D7.5
	November 2012	Release 7 evaluation	Heuristic evaluation, think-aloud method, experience interview	Colleagues	D7.5
	February / March 2013	Technical Trial	Two diaries comparison	People from previous surveys	D7.5
Operation	April – December 2013	Living Lab	The use of tripzoom	Travelling public as users	D7.5
	November / December 2013	Questionnaire survey	Exploratory and evaluation	Travelling public as users	D7.5
	November / December 2013	Focus Groups	Exploratory and evaluation	Travelling public as users	D7.5

The focus of the rest of this deliverable will be on the Living Lab phase and the experiments that took place within the Living Lab.

2.5 Lessons learnt & good practice

Prior to describing the details of the Living Lab operation, there are some useful lessons that had already emerged concerning the design of the Living Lab.

Organisational model for Living Lab Operations
By using a model for the Living Lab Operation, preparations could be done in a more structured way. Early user involvement highlighted main topics on which the Living Lab Co-ordinator might expect feedback. In order maintain good practice around the format and operation of the Living Lab, a Management Model was designed and adopted, as visualised in Figure 2-2.

Structured design
One of the main challenges in designing the experiments is the wide set of optimisation parameters. On the one hand, a meaningful and personal user experience is desired. On the other, there are system and project level goals to be achieved. For a successful experimental design, both should be taken into consideration from the outset.

Pre-Operational Stage
The pre-operational stage proved to be an essential part of the implementation of tripzoom in the Living Lab. During this controlled stage where the app was used intensively and tested on all its features, a lot of improvements were made. During the operational stage, technical issues were quite often a trigger for people to drop out.

Balancing act
The operation of a Living Lab is a balancing act; on one hand a stable Living Lab worthy system was desirable to prevent drop outs, on the other hand users made change requests and hoped to see them implemented. Expectations of users regarding the amount of changes to be realised have to be managed from the start. Ideally, there would be a great deal of flexibility in the system components as this would allow for user involvement in the design. However, users also expect a functioning system which requires high system stability and availability.

The central role of the Living Lab Co-ordinator
The Living Lab Co-ordinator served as the hub between all different activities within the Living Lab. As this was one of the project team members, there was also a good understanding of the system and close contact with the developers. This proved to be a successful strategy as all relevant knowledge was centralised and there where strong ties with relevant stakeholders. For instance in serving as a helpdesk, the Living Lab Co-ordinator should be able to explain to the user the requirements for joining, and should be sufficiently technically knowledgeable to address relevant queries regarding the system. However, there is also a vulnerability related to this central role, as a lot of knowledge is lost when the Living Lab Co-ordinator might become unavailable.

3. Preparation for the Living Lab

A range of activities took place in Leeds to recruit users for the various stages of the Leeds Living Lab. These had similarities with other European FP7-ICT research projects – e.g. SmartSantander, TEFIS, ELLIOT (Schaffers et al, 2011) and other research in Europe utilising Living Labs (Niitamo et al, 2012). These activities have been comparable and in coordination with corresponding activities which took place in the other two SUNSET Living Labs i.e. in Enschede and Gothenburg, taking into account the role of the reference Living Labs.

3.1 tripzoom system

The system design and development of tripzoom were organised within work package 2 (server components), work package 4 (mobile client) and work package 5 (system integration). Overall, the work in the Living Labs regarding the system development comprised a series of evaluations of different software releases. These were firstly based on project members acting as end users, and later involved a set of 'friendly' end users. The results of these evaluations are documented in D7.5. As outlined in Table 2-2, a range of activities took place in Leeds during the system testing period and whilst preparing for the Living Lab. These included evaluation activities with the SUNSET team in Leeds as well as evaluation by some friendly users in 2012 and 2013. These tasks have been followed up by the technical trial which focused on the IMP in particular in Leeds.

7.1.1 Release evaluation with the project team

The functionality of tripzoom has evolved gradually over the duration of SUNSET and adopted the co-creation approach (Pergler and Tarcus, 2013), as outlined in chapter 2. In the first six releases (Table 2-2), the application was evaluated by a team of internal testers all of whom were members of the SUNSET consortium and travelled in Leeds regularly. As a result they were able to meet the technical requirements of the predefined features to be tested. The testing did not take too much user effort as the only requirement was to turn tripzoom on and then offer feedback. Offering feedback however required significant time and effort as notes had to be taken and then communicated to the evaluation manager. One to three individuals acted as evaluators at this stage, testing the different release versions (1-6). These releases focused mainly on the technical functionality of the system. Tasks included checking all major user interfaces, system functionality and trip registration by tripzoom. Feedback was given to the evaluation manager through a form but also in free format by e-mail (see evaluation form in Appendix A).

7.1.2 Release evaluation with external friendly users

A number of friendly users were involved in the seventh release development and testing (Table 2-2). These were three colleagues at the University of Leeds with no particular knowledge about SUNSET, but who worked closely together with the SUNSET team during that phase. The aim of that release was to create a broader group of users and to specifically test the registration process with new users, who could offer constructive feedback acknowledging that this was a work in progress.

The attributes tested have been based on similar research (Gustarini et al, 2013) which has been adapted for the SUNSET context. The friendly users selected used both types of smartphone (i-phone, android) ensuring device heterogeneity, travelled by various modes (car, bus, bicycle, on foot) and after completing their registration were asked to report on tripzoom trip detection accuracy too. In addition, they were asked to respond on pre-designed challenges and ESQs

(Table 3-1). The feedback from those friendly users was received through regular face-to-face meetings ('think- aloud' method), e-mail and the evaluation forms (Appendix A).

Table 3-1: Examples of sensible challenges and ESQs to be tested by the Leeds Living Lab during technical trial

Examples of sensible challenges
Challenge 1: Starting on day -5 (so it is in the app, no notification). Get 10 points for every bike trip. Say something about healthy life style and the upcoming winter weather.
Challenge 2: (Starting on day -5, valid to day 7) Get 80 points for every foot trip >2km. Say something on healthy life style.
Challenge 3: Give one point to all car to home trips. Start day -5. Say something about the system. We want rewards for all.
Challenge 4: Give notification on first Friday in evaluation period. Incentive starts Monday, valid on weekdays, for two weeks. Give 100 points for each bus trip. In text say something about commuting by bus and therefore getting points on each weekday you travel by bus.

Examples of sensible ESQ's
ESQ 1: "Did you already fill in your user profile? This will help us to personalise the messages we get to you." [Yes;No] Valid after each trip, given only once, starting on day 2. Valid for a week.
ESQ 2: "Is the language setting in your app ok?" [Yes;No] Valid after each trip, given only once, starting on day 4. Valid for a week.
ESQ 3: "Did you know parking is cheaper in garages than on street?" [Yes;No] Valid after each car trip, given only once, starting on day 6. Valid for a week.
ESQ 4: "How is the weather for cycling today?" [Very good; good; average; bad; very bad]. Valid from day 7, once a day at 18:00
ESQ 5: "How good was your train trip rated on a scale from 1 (bad) to 5 (very good)?" [1;2;3;4;5] Valid from day 7, after each train trip, given once a day.

Feedback included comments on registration issues (e.g. use of Testflight for i-phones), battery usage, trip detection inaccuracy, non-receipt of challenges/ESQs or how to accept a challenge, but also positive ones about functionality, design, privacy options and concept of tripzoom.

One of the positive test outcomes for the development of tripzoom at this stage was identifying that no option was given to the Living Lab Co-ordinator regarding the start and end date of an ESQ, or that users were not able to rename specific locations. Those aspects were reviewed and amended by the SUNSET technical team and improvements were incorporated in the final tripzoom version R8.

7.1.3 Technical trial

A technical trial was greed by the three SUNSET Living Labs subsequently to build on feedback by the friendly users. After a short period of improvements by the SUNSET technical team, new users were invited to test tripzoom. In Leeds these users were from those involved in WP3 (Table 2.2) but also completely new users with no prior experience with SUNSET. The technical trial was the first occasion where tripzoom was tested by someone outside the SUNSET team in Leeds. This

was anticipated to be an important step in the process providing insight from friendly but real users of the tripzoom application.

Two focus groups have been held for this purpose in February and March 2013. Compensation was offered at the end of the technical trial and all participants were briefed about SUNSET and the requirements of this task. They were asked to monitor their trips for a period of two weeks (similar to the DRM suggested by Kahneman et al (2004)), but also to contrast their actual trips with the trips detected by tripzoom. An effective approach used at this stage was to involve users as 'co-designers'. This involved a £20 compensation to those fully completing the 2-week evaluation period and resulted in a good response rate. An evaluation spreadsheet (Figure 3-1) had to be completed daily by each 'co-designer'. This proved to be a demanding task for co-designers in Leeds, but this task was left until the end of the test due to a number of initial registration difficulties encountered earlier in the process.

Figure 3-1: Example of the travel diary which 'co-designers' had to complete daily during the technical trial.

The final testing activity took place in Leeds during May and August 2013 (Table 2-2). This activity was undertaken by the SUNSET team in Leeds and focused on identifying any remaining issues with the IMP before the actual Living Lab was launched. The main issue identified through this process was that the IMP did not communicate directly with the trip database. The implication was that the Living Lab Co-ordinator could not have a clear overview of challenges received and points rewarded, which had implications on the design and issuing of further challenges. This issue is discussed further in D7.5.

7.1.4 Submission to app stores
The final step in preparations was submission to the Apple App Store and the Google Play Store.

3.2 Data protection and management

A range of data management issues have been addressed in Leeds, which distinguishes this Living Lab from the other two SUNSET Living Lab and offers valuable insight on this topic. This chapter describes the data protection and management issues relevant to the Leeds Living Lab, along with the actions taken and procedures followed to fulfill the EU, UK and UoL obligations. In practice it became a more burdensome task compared with initial expectations. This may be due to the different context and policies in place in the UK compared to Sweden and The Netherlands, as well as a consequence of the novel context of this study. After outlining some broader SUNSET/ tripzoom issues, this chapter presents the issues relevant to the Living Lab Co-ordinator in Leeds and then to the users in Leeds.

The wider SUNSET privacy framework has been put in operation in each Living Lab. According to the basic principles and the usability testing explained in D6.1, the approach adopted within SUNSET has been to apply high standards regarding privacy and to draw on the minimum level of potentially sensitive information from tripzoom users. Transparency has been enhanced by the decision to implement an opt-in policy instead of the alternative opt-out policy. Additionally, users have the option to amend their privacy settings within tripzoom after they register (see also the description of Registration flow in Section 4.4). The focus in this deliverable is in Stage 3, which is depicted in Figure 3-2.
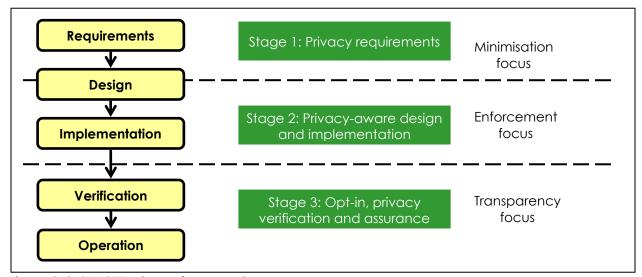
Figure 3-2: SUNSET privacy framework

SUNSET has complied with all relevant national and EU regulation and directives in order to ensure safety and privacy following a *privacy-by-default* and a *privacy-by-design* approach. The approach is compliant with the current status 2012 EU legal framework on the protection of personal data. (see also http://ec.europa.eu/justice/data-protection/index_en.htm)

In order to protect data of users and to assure privacy is maintained our approach consists of three elements:

A minimisation focus. The collection of personal information is kept to a strict minimum in the design of the Tripzoom app and the Living Lab operation. Data anonymity is the default option for research-related analysis purposes.

An enforcement focus. When users opt-in, personal data is protected by appropriate (technical and procedural) security safeguards against risks as loss or unauthorized access, modification or disclosure of data.

A transparency focus. Users should be able to trust the system. The SUNSET team have provided transparency to each user on the way privacy preservation is ensured and what types of data will be collected. Moreover, we provided user insight into all personal data gathered and a mechanism where user data is fully deleted from the system on request.

7.1.5 tripzoom data management

Data collection
Since tripzoom was an alpha service designed to provide incentives to travellers in order to optimise their mobility behaviour, the smartphone application needed to collect location data. In addition, some other personal data were collected for each user, based on their device, location and use of social media. Data were collected through a range of channels:

- automated sensing
- manual data entry about trips
- experience sampling
- questionnaires

and included location measurements, trips, mobility profile, regular trips, personal places, travel accompaniment, power measurements, errors, experience samples, profile information, friends, user preferences and user credentials. Anyone registering with tripzoom either through the iStore, GooglePlay or the tripzoom web-portal became aware of this need to collect such data through the Terms of Service (http://tripzoom.eu/portal/terms.php) and Privacy (http://tripzoom.eu/portal/privacy.php) webpages.

Data storage
All data were stored in password protected servers in the UK and The Netherlands, where only qualified researchers from the project team had access. Data will be stored for a maximum period of six years according to EU and UK legislation.

Data use
All data collected were anonymised by assigning a unique user ID to all registered users. It was explicitly stated to users that all data has been solely used to fulfil the SUNSET research objectives. These anonymised data may be used in future research, but it would not be possible to trace any specific individual through these data as only a User Name and User ID were used in the respective databases.

However, users were also made aware that part of their data was shared with other service providers (e.g. Google, Facebook, Twitter), given that the use of their smartphone was based on those service providers' user agreements. All tripzoom users needed to explicitly give their consent through the opt-in scheme in order to share their data with third party providers (D5.3) e.g. private organisations which may become tripzoom partners in the future (chapter 9). Therefore, all users had the option to opt-out and delete their tripzoom account with no further consequence or obligation, in the interest of transparency.

7.1.6 Operation

After implementing the first two steps of the framework in the technical system, verification and operation took place as part of the Living Lab operation. Within the Living Labs, user text for all of the consent stages were developed and operationalised by all of the Living Labs. For the Leeds case, the University of Leeds solicitor and the Ethics Committee were both involved in the review of the privacy scheme and invited to give some feedback on choices made.

The privacy regulation was made an integral part of the registration process, as will be described in Chapter 4**Error! Reference source not found.**. During registration, users had to explicitly opt-in at several stages:

- Downloading the app – Allow the use of smart phone sensors;
- Account registration – Accept the terms & conditions, as well as the privacy regulation;
- Logging into the app – Agree with measurement and storage of location traces.

7.1.7 Privacy registration

Within the Leeds context, a mandatory phase of agreement to take part in a research project had to be added as a stage in the registration process. This meant that the Leeds experience for users differed from the experience of simply downloading an app from the Google Play store or from the Apple Store.

Within the University of Leeds there was little prior knowledge or experience of using apps in research work in this way, i.e directly with members of the public, which meant that the registration design process was thoroughly examined before implementation was approved.

Within the SUNSET scope, the involvement of Leeds as Living Lab Co-ordinator made registration necessary, but also stimulated discussions about how to achieve an authentic app download experience within a Living Lab whilst adhering to University good ethical standards of transparency and accountability. In the end it was agreed that there had to be a two-stage process of registration to use the app and registration to take part in a research project.

7.1.8 Living Lab Co-ordinator issues

The Living Lab Co-ordinator in Leeds had to abide to both the UK legislation and University of Leeds guidelines. As a consequence, a considerable amount of time and effort was invested in this task in Leeds to ensure that all issues potentially arising had been considered and appropriate measures and precautions were in place.

In Leeds this was realised through a review of the local partner (UNIVLEEDS) data protection policy in conjunction with regular meetings and consultation with the Ethics Committee. This process lasted about six months and the outcome was a quite detailed set of guidance and material (see for example the Information Leaflet and the Consent Form in the Appendix B and C) and ensured the highest possible degree of data protection according to EU and UK legislation.

A series of precautions were applied through this procedure in Leeds:

- explicit consent was requested from all interested users
- the risk of any vulnerable user (e.g. children, individuals with disabilities) groups participating in the tripzoom survey was assessed and precautions were taken
- all members of the SUNSET team in Leeds were made explicitly aware of this procedure and the precautions in place

- attention was made to the language used in communications to ensure it was comprehensible by the lay person
- all registered participants were offered the option to withdraw from the tripzoom survey and have their data deleted through a predefined procedure
- all users were informed about receiving further guidance and assistance if needed
- user input and data was kept to a the lowest possible level to safeguard privacy, whilst also seeking to meet the tripzoom survey targets
- all reasonable steps to preserve data confidentiality and security were taken and the procedures in place were developed in collaboration with UoL and other SUNSET partners

7.1.9 User issues

Users in Leeds were recruited mainly through employer networks (chapter 4) which provided some reassurance to users about the tripzoom service, but individual users were also recruited through other channels (chapter 4). However, all users participated in the Leeds Living Lab voluntarily and were able to withdraw at any point without any negative consequence.

During the registration process (section 4.4) with tripzoom all users in Leeds were requested to complete an informed consent form (Appendix C) prior to the activation of their tripzoom account. They were also given an information leaflet (Appendix B) explaining the data collected by tripzoom and the options for users to withdraw and delete their data.

Privacy and anonymity have been key issues of concern for some users, as was also established during the WP3 focus groups conducted in Leeds (section 3.7.2 in D3.3). These issues were addressed through the Privacy (http://tripzoom.eu/portal/privacy.php) and FAQ (http://tripzoom.eu/portal/faq.php) webpages available at the tripzoom portal and by anonymising all data upon collection. No names, login names or other personal data were used to identify users. Instead a unique user ID was used, which safeguarded anonymity for all users. All data about user trips or challenges received was solely linked with the User ID and all these data were stored in a secure server in The Netherlands where only qualified researchers had password protected access.

The actions described in this chapter ensured that the approach in Leeds complied with the EU, UK and UoL regulations regarding data management. In case any disputes arose through the use of tripzoom, users could contact the respective local SUNSET partner (UNIVLEEDS) and subsequently the Project Co-ordinator using the contact details provided if needed. The applicable jurisdiction was the one of Almelo in The Netherlands.

3.3 Stakeholder involvement

As highlighted already (and further discussed in chapter 4), a wide variety of stakeholders were contacted at various stages of the Leeds Living Lab. These can be summarised in two groups. The first involved those who were seen as collaborators of SUNSET and were consulted in the preparations of the Living Lab e.g. to discuss the type of challenges:

- City Council
- Universities
- Public transport operators
- Transport operators

The second group was broader and included those stakeholders utilised to assist in user recruitment:

- West Yorkshire Travel Plan Network (over 100 employers interested in low carbon travel)
- City Centre employers (financial institutions, recruiters)
- Hospitals
- Fitness centres
- Local activity groups (e.g. sports, social)
- Miscellaneous groups (conacted through social media and mailing lists)

One key stakeholder was West Yorkshire Travel Plan Network. We contacted and established a good relationship with them from an early stage, but it became clear that there was a difference in our respective time horizons. The Leeds Living Lab had a need to recruit intensively over a short period of time whilst the WYTPN had a need to maintain a longer term relationship with the members. The Leeds Living Lab therefore sought additional methods to recruit users.

An important message from the Leeds Living Lab was that stakeholders may be able to assist in the preparation and implementation of a Living Lab, but at the same time they may impede some aspects due to their diverse time plans and objectives. The experience from Leeds may prove useful in highlighting that specific resources should be assigned to enable stakeholder involvement as an active partner in meeting the Living Lab targets within predefined timeframes.

3.4 Lessons learnt

Findings of this chapter build on knowledge presented in D6.1 and are useful for other Living Labs as the development and testing stages are crucial for the success of SUNSET type approaches. The following are the key lessons learnt from the Leeds Living Lab:

- The Leeds Living Lab has resulted in the designed and implementation of a strong ethical framework within which experiments of this type could be conducted
- Consortium partners may have to act as test users
- It is desirable to have a pool of diverse friendly users
- A relevant range of devices and travel modes is required
- Direct and user-friendly feedback methods are required for testing
- A helpdesk may be required depending on the testing context
- Communication channels need to be established and maintained between the software development and Living Lab Co-ordinator teams

Data protection and management have proved to be important issues in the Leeds Living Lab and these required a significant time investment. It is essential to establish relevant procedures on these aspects at an organisational, national and international level. Concerns about privacy can be interpreted in two ways: either those with privacy concerns decided not to participate at the Leeds Living Lab or tripzoom offered adequate options for privacy management to those who participated. Equally, the collaboration with stakeholders has to be cautiously planned in advance in order to take into account their varying objectives and timeframes.

4. Establishing the Living Lab

4.1 Early user involvement

A stepwise approach was implemented in Leeds during the various phases of SUNSET (section 2.4), whilst tripzoom was in its early releases, i.e. until release R7. This approach fed into the Leeds Living Lab phase which started in August 2013 (section 2.4) where tripzoom R8 was used including minor updates. Therefore, participants in the WP1 initial survey were contacted through local mailing lists and Facebook groups. Identifying potentially interested groups, contacting the mailing list administrator and explaining the SUNSET concept entailed arranging meetings at convenient times for all parties involved. These meetings took between one and two hours each to respond to stakeholders clarifying queries about tripzoom background and functionality in the local context. This was a slow process with limited return in actual users despite the high stakeholder interest about SUNSET as demonstrated by e.g. Leeds City Council or First Group. However, most participants in Leeds at that stage were undergraduate students at the two Universities in Leeds. This on-line questionnaire included 95 questions, offered no compensation to those who completed it (i.e. compensation for the time needed to complete the WP1 questionnaire) and took between 30-45 minutes for respondents to complete. 24 users completed the WP1 survey in Leeds which was a relatively low response rate given that more than 50 local groups and mailing lists have been contacted regarding that survey. This was a helpful finding for the remainder of the Living Lab.

User input was required to review and receive early feedback about the incentives to be tested within the SUNSET Living Labs, so it was deemed useful to hold focus groups within WP3 (Table 2.2). Focus groups offer key benefits when conducting qualitative research since they can (Greenbaum, 1998; Harding, 2013):

- offer quick feedback about a new notion still under development (e.g. tripzoom R4)
- allow respondents to express themselves in their own way and in real time since the researcher solely acts as a moderator ensuring that the discussion flows to cover the anticipated topics
- condense a range of diverse views within limited time, offering researchers more time for analysis
- offer deeper insight to researchers about the dynamic influence of diverse views on respondents' responses when reviewing new notions (e.g. SUNSET in this case)

These are specific advantages of focus groups in comparison to interviews or on-line surveys for example and therefore this method was selected as the most appropriate. Two focus groups of 14 people in total were held at the University of Leeds on 7th and 12th June 2012. In co-ordination with the other SUNSET Living Labs, a sum of £10 was offered to each focus group participant in Leeds to compensate for their time and travel costs to the focus group location. The majority of those participants were recruited through an invitation circulated through the Leeds City Council intranet. Other focus group participants were recruited through the wider University of Leeds community, the Leeds SUNSET Facebook page and local stakeholders. A Facebook campaign with a budget over £400 was active during June and July 2012 for that recruitment stage. The experience acquired was helpful for the Leeds Living Lab recruitment overall.

In parallel with the heuristic evaluation and the cognitive walkthrough, an additional on-line survey took place in July 2012 where 93 participants responded. These respondents were

introduced to SUNSET and it was anticipated these participants may also take part in a later stage of the Leeds Living Lab. They were recruited through relevant mailing lists (e.g. HEIs, NHS), local Facebook groups, the Leeds SUNSET Facebook page and posters put in Community Centres around Leeds. This on-line survey asked participants to attend a 30 minute computer cluster session at the University of Leeds (offered on either a weekday or the weekend) and complete an on-line questionnaire. The aim of this survey was to acquire user input from Leeds about the incentives designed within WP3 which would then allow feedback into their design. Questions were asking about participants' travel in Leeds, smartphone features and use, attitudes towards specific incentives e.g. traffic information updates, information sharing through social media and their socio-economic background. The data collected were used to amend the challenges and incentives of the Leeds Living Lab.

4.2 Target group

The Leeds Living Lab target group was initially outlined in D1.1 and D5.3. According to D5.3, which identified the specific user segments, the focus in Leeds was intended to be on:

- car commuters
- congestion busters
- rail users
- early adopters and/or technology enthusiasts
- large employers

These broad target group were distilled in D7.1 to specify the actual users who would constitute the Leeds Living Lab, based on the available time and resources. The two categories identified were based on:

- a spatial categorisation i.e. car drivers on the A61 corridor to/from North Leeds
- a socio-economic categorisation i.e. time poor travellers in Leeds city centre

Three factors were identified as important for users during the design phase according to Gustarini et al (2013), namely the ethics consent approval, the registration process and the variables to be tested. These are discussed in more detail in the subsequent chapters. In practice, in the Leeds Living Lab the communication of the desired sample characteristics to users was not a straightforward process and this had implications for the variables to be tested. These implications were intensified by introducing an innovative technology based notion i.e. tripzoom at the same time. These aspects were reflected in some of the comments received from users in Leeds during the Living Lab recruitment.

> *Having read the information form, whilst I remain very interested in the
> project I wonder if I really fit the bill for one of your test subjects
> as whilst I have had a face book page for about three years I have
> never knowingly maintained it or taken any interest in it. I do not have
> a twitter account or other social media app that I use.
> In the circumstances I honestly think it would be a wasted place if I
> took part. If you do run a later separate trial for curmudgeonly old gits,
> please do not hesitate to let me know as I would be more than pleased
> to assist you and your colleagues in your research.*
>
> 4th September 2013 by e-mail

Therefore, the amended D7.1 user features sought in Leeds were:

- use of an appropriate smartphone
- frequent/occasional car driver in Leeds
- aged over 18

Priority was initially given to a specific group of large employers within Leeds city centre in an attempt to create a spatially concentrated group of users. This was based on suggestions arising from both D5.3 and D7.1.

4.3 User recruitment

Living Labs are being increasingly used within research projects, specific examples include those funded by the European Commission. They have been defined as a real-life test and experimentation environment where users and producers co-create innovations (ENoLL, 2012). An amalgam of established methods was used in the build-up to the official launch of the Leeds Living Lab in September 2013 to try and maximise engagement based on the available resources. The major focus was on recruitment, but considerable time was also devoted in Leeds to complete the registration and consent form stages, as well as to define and set up user groups through the City Dashboard (Figure 4-17). One of the main recruitment channels used was the West Yorkshire Travel Plan Network (WYTPN) which is managed by West Yorkshire Metro. Eight employers (Figure 4-2) located in a city centre location were initially selected (six around location B and E) to ensure a relevant spatial focus for the Leeds Living Lab. Employers at locations A and D (Figure 4-2) were also included due to the high number of employees. Such a spatial concentration within a limited geographical area could potentially offer synergies for car sharing, joint travel and exchange of information about traffic conditions through social media, all of which would be relevant to the overall SUNSET objectives.
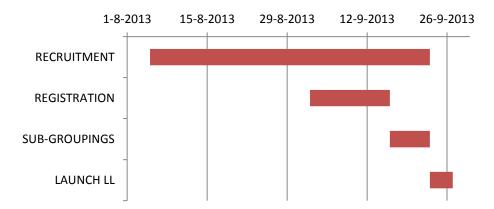

Figure 4-1: Initial recruitment timeplan of the Leeds Living Lab

Figure 4-2: Location of employers in the initial sample (six employers were located around B and E).

Following the first notification to these selected employers, a wider invitation was circulated to all employees within the WYTPN. This network circulated a monthly newsletter (Figure 4-3) and included over 150 employers in West Yorkshire with a large number located in Leeds. In addition, previously established mailing lists and intranets (e.g. LCC, HEIs, NHS) were used. A small compensation of £20 was offered to users working at certain locations to encourage spatial concentration of users which would be beneficial for this Living Lab.

Moreover, the snowballing technique (Atkinson and Flint, 2001) was employed to obtain access to gatekeepers who could facilitate the recruitment of participants fulfilling the survey requirements. Despite the criticism of this approach by some scholars (Biernacki and Waldorf, 1981; Bernard and Ryan, 2010), it could be valuable in this type of research settings due to the spatial, social and technological requirements of a Living Lab. Therefore, further networks were contacted through the WYTPN and face to face meetings were arranged with gatekeepers at Leeds City Council or with the University of Leeds Travel Co-ordinator. Nevertheless, these efforts resulted in limited user recruitment due to the timing of this SUNSET task which was competing with other events and actions in Leeds planned by the organisations.

Cold calling large employers e.g. financial institutions was therefore used as an alternative. Example employers were:

- Leeds Building Society
- Lloyds Banking Group
- HBOS – Halifax Bank of Scotland (owned by Lloyds TSB)
- Department of Work and Pensions
- Leeds City Council (selected services located in buildings within the city centre)
- Leeds City College (city centre locations)

- Recruitment agencies within Leeds city centre

The outcome demonstrated that gaining access to such employers can be extremely difficult as they are generally not willing to disclose employee information or engage in surveys of this type, which may distract employees from their main work tasks.
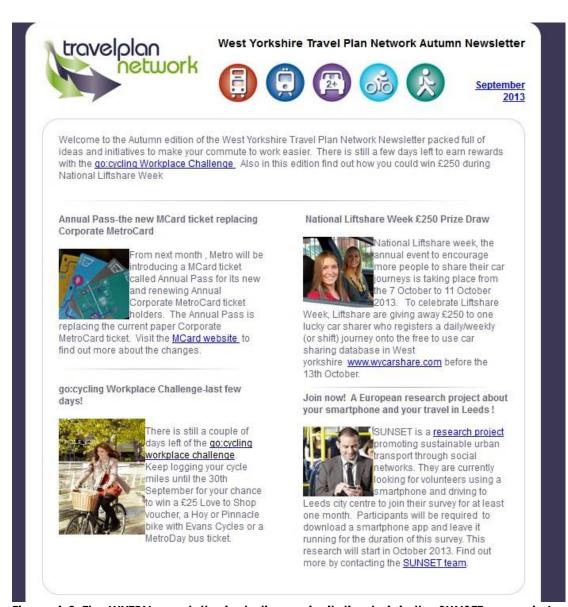

Figure 4-3: The WYTPN newsletter including an invitation to join the SUNSET survey in Leeds

Figure 4-4: Recruitment leaflets distributed at car parks in Leeds city centre

Other recruitment actions included the distribution of over 1000 leaflets (Figure 4-4) at three car parks (Figure 4-5) located within Leeds city centre on three weekdays, with necessary authorisation from the local authorities. This authorisation was essential for any leafleting activity taking place within the designated by the City Council area of Leeds city centre and was another administrative requirement which reduced flexibility in the Leeds Living Lab. A license and five badges were acquired for one month at a cost of £250 for five distributors and a supervisor. Local regulations were strict in defining precisely where and how leaflets should be distributed. Leaflets were distributed on the morning (07:00-09:00) and evening (16:00-18:00) peak times.

These particular parks were selected to ensure sufficient diversity across the range of car parks available in the city centre area (Figure 4-5). Two were closed car parks providing a higher level of safety to vehicles and individuals, whilst one was open air one. Parking fees were relatively low at two of them, whereas they were significantly higher at the other one. This would allow targeting of individuals with higher incomes or higher value of time – due to the car park's proximity to major business offices. One of the car parks offered a flat day rate whereas another offered a flat rate until 7pm - encouraging individuals either to stay longer at work or to combine shopping and leisure activities after work. Given these characteristics, it was anticipated that a variety of individuals could be targeted for the Leeds Living Lab based on their work pattern (full/part-time, fixed/flexible working hours).
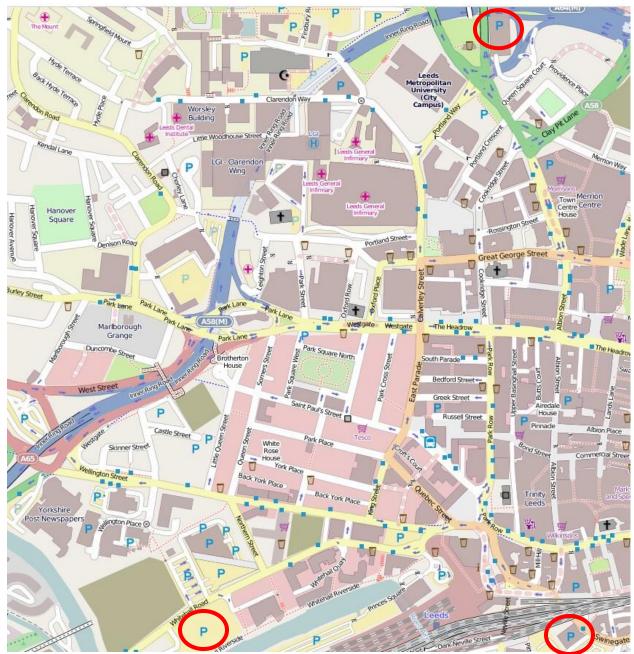
Figure 4-5: Car park locations around Leeds city centre where recruitment leaflets were distributed

Local press (Figure 4-6) was also been used to increase publicity through an announcement in the Yorkshire Evening Post - a widely read newspaper in Leeds - and North Leeds Life magazine. The Yorkshire Evening Post circulated about 29 000 printed copies daily in 2013 which reached more than 100 000 adults in the region, whereas North Leeds Life magazine (with an apparent local community focus) circulated about 40 000 printed copies each month in North Leeds, around the A61 route. The resources of the University of Leeds were also utilised in the form of a call for participation at the ITS main website, a press release distributed both in digital and hard copy formats and distribution of the recruitment call through the University Travel Plan Co-ordinator (UTravelActive) contacts with major local employers.

The Transport Systems Hub (TSH) is an innovative channel used in the Leeds Living Lab and is a newly established initiative to bring together researchers, industrial partners and local stakeholders in order to enhance multidisciplinary research. The TSH promoted the invitation to join the Leeds SUNSET Living Lab through Twitter and its dedicated webpage (Figure 4-7). In addition, the recruitment invitation was also been distributed through local mailing lists and at least two reminders were circulated.

Part of the advertisement published by the major local newspaper in Leeds

North Leeds Life magazine entry distributed around the A61 trunk road

Figure 4-6: Local press where an invitation to join tripzoom and the Leeds Living Lab was circulated

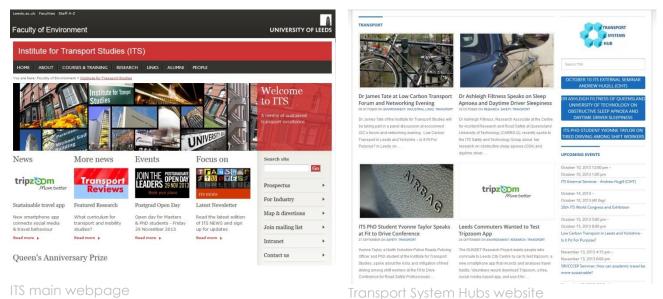ITS main webpage   Transport System Hubs website

Figure 4-7: Other websites and social media used to publicise recruitment activities

Facebook was also used to increase awareness through social media and this mechanism was aligned with the SUNSET objectives. Figure 4-8 provides an overview of all the SUNSET related information utilised in the Leeds tripzoom Facebook page. Employing social media, which the majority of smartphone users use regularly (a finding from the survey reported in D1.1), offers the opportunity to include participants with various features in the sample. This approach also overcomes the sample bias limitation (which has been reported for the snowballing technique) since participants may not only be derived through referrals but also through new contacts or networks (Bhutta, 2012). The latter is founded on the newly established notion of the power of social networks for either positive or negative influence (Christakis and Fowler, 2009). In the context of SUNSET this could be translated as walking or cycling more for example, influenced by friends, relatives or colleagues. The average Facebook user has been reported to have 229 Facebook friends (Hampton et al, 2011) and given that friends are able to see the activity of other friends, it was anticipated that a Facebook recruitment campaign would generate the required critical mass for the Leeds Living Lab, fulfilling the social networks dimension of SUNSET at the same time. The fact that Facebook users share a significant amount of personal information on social media websites may, however, make some users more cautious in responding to and joining this type of survey. This is in contrast to the widespread view that other on-line surveys (not facilitated through Facebook) attract larger and wider samples as respondents remain anonymous.
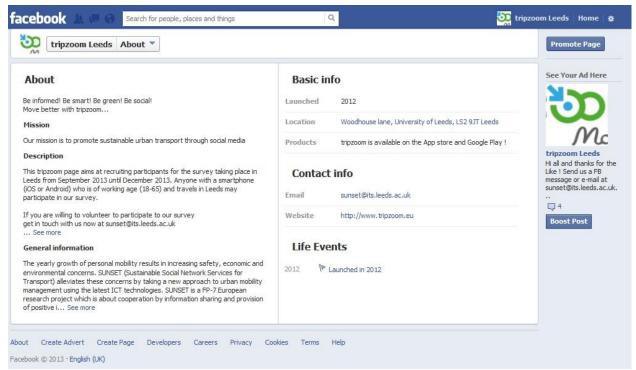
Figure 4-8: Overview of the background information included in the About Leeds tripzoom Facebook page

Material was posted on a dedicated Leeds tripzoom Facebook page and a Facebook paid advertising campaign was designed and executed resulting in 50 page Likes (Figure 4-9). The steps followed for this campaign in Leeds were to:

- find an available, meaningful, easy name for the Facebook page
- decide which key information to input as background (Figure 3.8)
- design and upload relevant and interesting pictures
- write succinct messages to guide page visitors appropriately
- offer direct or alternative communication options to visitors
- decide about the campaign duration, daily and overall budgets
- monitor campaign and page regularly

Compensation was offered to participants to join, acknowledging their time commitment and smartphone charging costs, whilst building on previous experience with users in Leeds (i.e in WP3). The overall cost for paid Facebook advertisements in Leeds was over £600. Facebook campaigns offer the option to attract users with specific characteristics e.g. location, age. Given that the aim in Leeds was not to include students in the sample, a range of features were used to attract a diverse but still targeted sample, in similar vein to other social research (Samuels and Zucco, 2013).

This resulted in 600 page visits at the peak of the campaign in October 2013 (Figure 4-10a). Notably, interest about the Leeds tripzoom Facebook page dropped significantly following the completion of the paid advertising campaign in the middle of October 2013 (Figures 4-10b and 4-10c). Consequently, most of these Facebook page visits and Likes were not converted to Living Lab participants following the initial screening stage. This was due to users being based outside the Living Lab focus area or not having an appropriate device, as highlighted by the following comment:

> *Hi, I'd love to help you out with this, would it work with a Windows phone?*
>
> 22nd October 2013 by e-mail

Consequently, there was a very high cost per Leeds Living Lab participant recruited through Facebook. Similar problems have been reported in the literature (e.g. Samuels and Zucco, 2013) and together with the inability to issue rewards or compensation payments directly through Facebook, some concerns about the contemporary use of social media within social research could be raised.

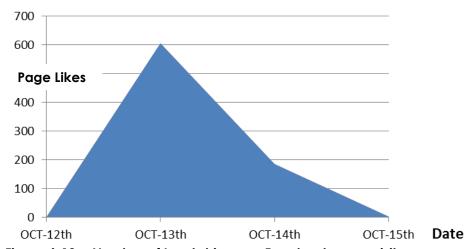**Figure 4-9: The Leeds tripzoom Facebook page**

Page visits

Page Likes

Figure 4-10a: Number of Leeds tripzoom Facebook page visits.
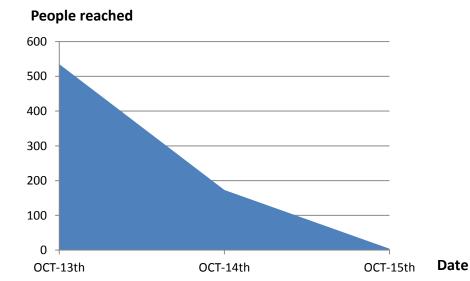
Date

People reached

Figure 4-10b: People organically[3] reached through the Leeds tripzoom page Timeline.

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[3] Organic reach: The number of unique people who saw your post in News Feed or on your Page, including people who saw it from a story shared by a friend when they liked, commented on or shared your post, answered a question or responded to an event.
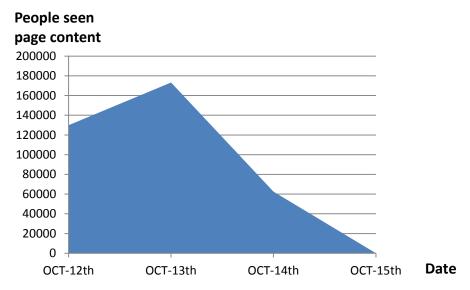
People seen page content

Figure 4-10c: Number of notifications associated with the Leeds tripzoom page on walls of Faceboook users.

Figure 4-10 (a, b, c): Activity and impact of the Leeds tripzoom page on Facebook during the peak of the paid advertising campaign (October 2013).

Significant time and resources were used to monitor social media such as Facebook and LinkedIn. These activities had to simultaneously comply with the wider publicity guidelines of the the University of Leeds, generate positive interest about the initiative (e.g. tripzoom survey recruitment for the Leeds Living Lab) and address the individual query. It is not common practice that a single individual runs a social media campaign. There was therefore a need for advance contingency plans to address any undesired situations promptly as social media may create a quick and lasting negative impression if not monitored regularly. It was proven through the Leeds Living Lab that constant monitoring and control is indispensable in order to manage expectations and quickly address any negative publicity through social media (Figure 4-11).
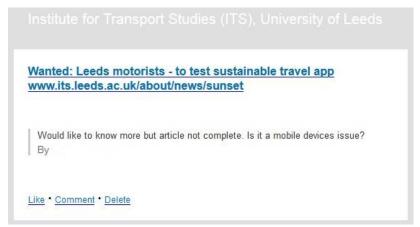

Figure 4-11: Comment on the ITS LinkedIn group highlighting the need for constant monitoring and control to avoid negative publicity.

Another recruitment channel used in Leeds was a cohort of 350 undergraduate students at the University of Leeds. Similar approaches for CO_2 reduction have been utilised elsewhere in the UK,

though in different contexts (Aragao, 2011). A short pitch to the students was followed by the distribution of the Consent form and Information leaflet (Appendix D), building up on the positive experience from WP1. However, this activity was not as effective on this occasion due to lower student interest and participation.

Overall the total number of recruited users for the Leeds Living Lab was lower than for the other two SUNSET Living Labs. Despite the 25 users who expressed interest to join the Living Lab, only 6 progressed to complete their registration and participate in the Living Lab. The comments below illustrate the fact that registration for the Leeds Living Lab was not straightforward and required users to invest more time and effort to participate.

> *Hi, I couldn't get the app to work last time and I was on a very low data package, but if you're on the lookout for cyclists/bus users, then please keep me on the books*
>
> 18th September, 2013 by e-mail

> *Hi, I have tried to register but the page is completely blank so I am unsure where to add my details. Can you help? Many thanks*
>
> 21st September 2013 by e-mail

> *Hi, I'm interested in taking part in this survey and wondered if you could send me some more information on how to take part! Many thanks*
>
> 3rd October 2013 by e-mail

The need for each user to complete and return a signed Consent form has been one of the major identified constraints to participation as users would prefer a one-step registration approach. In addition, technical and software glitches resulting in the need for users to contact the Living Lab administrator (as evidenced through the previous messages), meant that registration to the Living Lab was not seamless and as users anticipated, despite their expressed interest.

4.4 Registration work flow

Before running tripzoom, users have to go through several steps in order to be registered. This process was designed in such a way that the Living Lab Co-ordinator has full control over the sample. In the rest of this section the process will be described. In general, there are two ways to register (Figure 4-1). In the first case, the user account is registered on the mobile client in the app. In the second case, the account is registered using the website. In both cases the same registration process had to be followed. In the process that follows, the routing of the first case is described.

Figure 4-12: Roads to registration

Due to the procedures established to unsure a high level of data confidentiality and security (outlined in the previous chapter), the registration process in Leeds included an additional layer of interaction between the local SUNSET team and each user. Communication at this stage was mainly conducted by e-mail and aimed at receiving a signed consent form (Appendix C) by each registered tripzoom user in Leeds. Assuming that a user found out about the Leeds tripzoom survey through one of the communication channels (section 4.1) and had expressed interest to join, the Information Leaflet and Consent Form would be forwarded to this user by e-mail. Subsequent actions are shown in Figure 4-13.
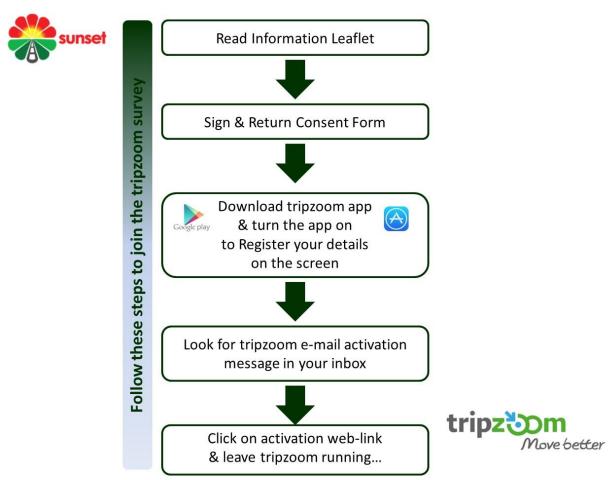

Figure 4-13: Overview of the registration process in the Leeds Living Lab

Downloading the app

The first action toward registration is downloading the app. Users could download tripzoom like any other app from either the Google Play Store (Figure 4-14) or the Apple App Store (Figure 4-15). Before downloading, the user had to opt in to let the app use several system features of the phone:

- Your location
- Network communication
- Storage
- Your accounts
- System diagnostic tools
- Influence on battery
- Information about your apps

Figure 4-14: tripzoom in Google Play

Figure 4-15: tripzoom in the App store

Registering an user account

After downloading, a welcome message asks the user to either log in or sign up and this message is localised based on the phones language setting. When clicking on Sign Up, the registration screen is displayed (Figure 4-16).
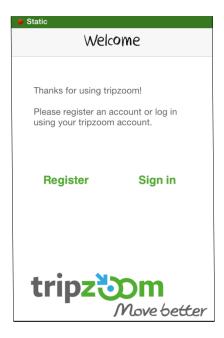
Figure 4-16: Registration welcomepage of tripzoom offering the option to Register a new account or Log-in as an existing user

The app displays a registration screen where the user can register by filling in their username, e-mail and a password. In addition, they have to agree with the Terms & Conditions of tripzoom by ticking the relevant box. Users have the option at this stage to be informed about the tripzoom survey details, the aim of data collection, and their freedom to withdraw if they wish so. The privacy protocol is also explained to users here if they decide to click and read it.

Registration takes place by filling in a username, display name, e-mail and a password. The user also has to agree with the participant consent (see Appendix A) in order to proceed. This consent informs users about the experiment, the aim of the data collection, and their freedom to act as they like. The privacy protocol and terms of service are also explained to the users (see Appendices B and C).

Once the user clicks on the green register button, a notification is given that tripzoom is a closed experiment. In order to complete registration, the user is asked to send a short e-mail asking permission to join.

The Living Lab Co-ordinator monitors the City Dashboard (Figure 4-17) in order to manually add users to the Lab. Those who did not send an e-mail but appear possibly eligible for the Dutch lab, based on either their name or the .nl extention of their e-mail address, were also added. Subsequently the Living Lab Co-ordinator sends the user an e-mail by way of welcome to the Living Lab. The system also sends an e-mail to the user, asking the user to validate the e-mail address used
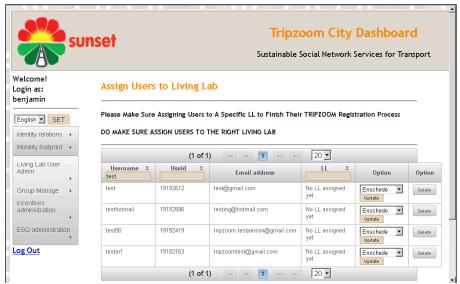
Figure 4-17: City Dashboard User Administration

Logging into the app

After the first log in there is a screen asking permission to actually measure the users' mobility profile. When the user clicks ok, he or she is ready to go. The app will be running in the background, but the user can check at any time to see progress.

Authorize Access

The tripzoom system requests access to the following information to function and to evaluate its usage:

☐   Travel behaviour: Locations you have been to and trips you have made
☐   Actual information: Your current location and whether you are travelling or not
☐   Personal information: Data from your user profile like name, email address or buddy list
☐   Application information: The energy the application uses and whether errors occurred
☐   Answers to pop-up questions

To create community overviews, we only use anonymized and aggregated data.

Facebook connection

In order to faclititate sharing on Facebook, an implementation process involving logging in with Facebook was introduced. Users have to register manually first using the same email address that they use with Facebook. This implementation process was introduced in order to be able to guarantee that consent was given adequeately. However in general, websites implement this differently. Users expect an equal workflow and struggled with the presence of a "Log in with Facebook" button that they could not get to work.

Overall, the registration stage is the process in the tripzoom software where the procedure in Leeds differed significantly compared to the one followed in Enschede and Gothenburg. In Leeds, the procedure resulted in registration taking between three and seven days, depending on the method chosen by each user to return the completed and signed consent form. At this point the Living Lab Co-ordinator had to check whether this particular user had already sent the signed consent form by e-mail or regular post. If the signed consent form had been already received, then the Living Lab co-ordinator in Leeds could activate the account. Where the signed consent form had not been received, then it had to be sent out with the relevant

guidelines. Alternatively a reminder had to be sent to the user to remind them that their tripzoom account would be activated once the signed consent form was received.

In practice, the approach in Leeds (Figure 4-12) was to first send the information leaflet and consent form following the initial expression of interest by a user and then to ask them to download the tripzoom app and register. The intention was to retain user interest high, as it was realised that the consent form stage may act as a deterrent for some users (section 4.3). Nevertheless, there were occasions where users either lost interest about the tripzoom survey or were not willing to complete the consent form stage, which led to a lower number of registered in the Leeds Living Lab. Despite the additional time and effort required by the SUNSET team in Leeds, this stage did, however, ensure that the procedure abided to local and national requirements.

After the initial user log-in, there was a tripzoom screen asking permission to track the users' mobility profile. Users had to allow this to enjoy full tripzoom functionality, but they had the option not to allow it if they did not wish so. Automated tripzoom updates, as well as GPS and Wi-Fi functionality allowed better data synchronisation and complemented the user experience too. In order to faclititate sharing on Facebook and comply with the SUNSET social networking objective, a Facebook registering and log-in functionality was also implemented. However, users had to register manually first before they were able to log in using Facebook. This implementation was designed deliberately to ensure that explicit consent would be given by each registered user and that tripzoom registration was not 'hidden' behind the Facebook registration and log-in. However, users expectations differed in the sense that they expected that through the "Log in with Facebook" button they would be able to register with tripzoom immediately, overcoming the additional registration stages. Consequently, in reality this registration channel did not work for the majority of users.

4.5 Lessons learnt

Overall it can be said that recruiting participants in Leeds was a significant challenge due to a range of reasons. The positive outcome is that the Leeds Living Lab has provided proof of those concepts and approaches that might work in similar settings in the future and highlighted some that would benefit from revision. These produced interesting points for future Living Lab to consider, but ultimately led to a relatively low number of participating users. Key issues to consider in similar tasks in the future would be:

- timing of recruitment
- cost of recruitment
- co-ordination with other local activities
- competitors who may wish to join the Living Lab due to other motives
- streamlining registration processes where feasible

It is crucial to plan user recruitment in advance so that time and funds can be used in the most effective way. Due to the need to resolve pending technical difficulties regarding the operation of the City Dashboard e.g. to issue incentives, recruitment was rescheduled a number of times in Leeds. This resulted in increased costs as additional communication channels were then needed. These included gatekeepers of large employers, the existing resources of the local SUNSET partner, leaflet distribution (Appendix D) and local press.

Overall timing is also important. The need to start recruitment of users for the Leeds Living Lab in August (when a lot of the users and gatekeepers identified in section 3.1 were on holiday) is another point which could be factored into future recruitment activities.

Communicating and co-ordinating recruitment efforts with other key local stakeholders proved fundamental in Leeds and identifying gatekeepers can aid significantly in this. Combining efforts with large employers (for example local government agencies, transport operators or financial institutions) and aligning resources (for example with initiatives such as the European Mobility week or the Cycle to work scheme events) could have presented a more timely and attractive message to users with a mutual benefit for all stakeholders. However this would need a longer forward planning horizon and more stable experimental schedule than may be possible with the dynamics of a technology based Living Lab context. Establishing provenance through association with established stakeholders and organisations may be necessary to build trust with users.

The process demonstrated that a small but immediate monetary compensation for inconvenience can play a role in successfully recruiting participants for the Living Lab. In this case an expectation around payment had been raised with some recruits who had previously taken part in WP3 experiments. However, generally the use of a small payment to reimburse costs such as battery drain, time in providing feedback, postage and inconvenience proved attractive to potential participants.

The interests and activities of competitors should also be taken into account in this type of experiment, given they have the option to either compete or complement such Living Labs using their own resources.

> *I must be honest and admit that my initial interest was actually two-fold. I'm keen to help improve the transport system in Leeds as I travel there or through there each day. The other reason is that at work we are currently leading the field in temporary installations of Bluetooth tracking units, which we use for both traffic and pedestrian tracking*
>
> 27th September 2013 by e-mail

> *OK, downloaded the app, and installed it [android model]. Upon registration, it has a message that currently all registrations are being done manually via an e-mail address, i.e. is that your remit?*
>
> 23rd October 2013 by e-mail

Another key outcome was the desirability of a straightforward and seamless registration process. This was a reasonable expectation of users when dealing with innovative technologies, but one which may turn into a deterrent factor if not met. The Leeds Living Lab in particular has demonstrated that the first impression of users when interacting with tripzoom was crucial and appeared to create a disproportionate impact on their decision on whether to join the Living Lab or not. In general, the key lesson to be learnt from the experience in Leeds is that Living Labs open up plenty of research opportunities (EC-ISM, 2009), but need to be adapted to the local environment and resources available.

5. User retention

Organising and managing Living Labs is a substantial and complex task, as outlined in Figure 5-1 and described by the other SUNSET Living Labs (D7.2, D7.4). Users need to provide their views and experiences and the Living Lab team – ideally including business, science and public authorities partners – needs to provide support, insights, challenges and of course manage expectations. The prerequisite to achieve this aim and run the Living Lab is to retain users. This is the topic that is addressed in more detail within this chapter.
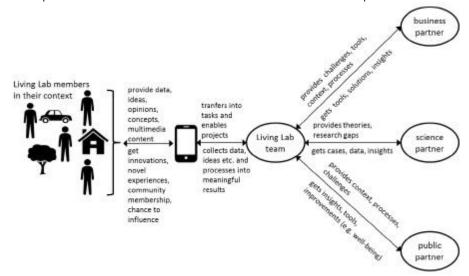

Figure 5-1: The relationships and processes within a mobile Living Lab (Pergler and Tarcus, 2013)

5.1 Communication channels

A number of communication channels were used in Leeds to initiate and maintain communication with users (Figure 5-2). Due to the need for a signed consent form for each user according to the data protection and management guidelines, communication was mainly conducted by e-mail. Yet, four registered users returned their signed consent forms by regular post demonstrating that conventional communication channels were still in use by individuals.

Figure 5-2: Communication channels used in Leeds

Additional communication channels included the three Facebook pages, designed and managed in Leeds and linked with the different Living Lab stages. Facebook has been used to communicate with users based on the successful use of this channel during the WP3 focus groups in June 2012 (Table 2-2). A further communication channel was face to face meetings with gatekeepers or users themselves. This took place during meetings with gatekeepers e.g. at Leeds City Council or West Yorkshire Metro and was followed up by telephone communication.

During the actual Living Lab phase, users were able to communicate with the Living Lab Co-ordinator by e-mail or telephone and could raise any issues also by post. In addition, the tripzoom portal offered users an option to interact with the Living Lab Co-ordinator as well as the local tripzoom community. However, this functionality was not supported directly through the tripzoom app so was not utilised in practice. Moreover, the Living Lab Co-ordinator arranged some meetings with individual users to acquire a better user insight through short interviews including open ended questions.

5.2 Living Lab Co-ordinator tools

In addition to communication outside tripzoom, there were some further features in the system that helped the Living Lab Co-ordinator to work with the users.

City Dashboard
The City Dashboard (Figure 5-3) is the central tool for the Living Lab Co-ordinator. Using this tool, three main actions are available:
- Management of Users
- Management of Challenges
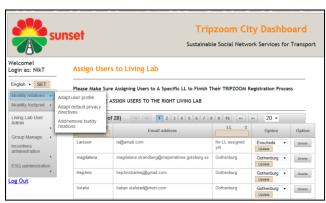- Management of Experience Sampling Questions

Figure 5-3: City Dashboard

Users can be assigned to Living Labs and groups using the City Dashboard. Some profile information can be retrieved, like username, user ID, e-mail address. As well as very useful information regarding the status of the account (e.g. registered or validated).

The Challenge Management facility was the main tool used to issue and monitor incentives. To register a new incentive though the Manual registration option, the respective fields needed to be filled in i.e. Incentive name, Notification Description (the challenge notification received by the user when a new incentive became available), Reward description (the notification received by the user when a challenge was met and some points are rewarded), the target Living Lab, the Repeat pattern (how often this incentive should be offered), incentive Start and

End times, Incentive Notification issue time (i.e. when users should be notified about this new incentive).

The Reward criteria conditions for this incentive then had to be set. The reward criteria could be based on cost, distance, CO_2 emissions, target group, TripObjective, TripModality. Several criteria could be set by filling in the desired value e.g. for distance and then clicking the Add button. Finally, the points to be rewarded when this challenge was met should be input at the bottom.

Experience Sampling Questions could be registered through the dashboard. The Living Lab Coordinator could type the question text, provide the different answers by adding them, make this ESQ active for tripzoom users at this time or not (Yes/No option), select the desired question frequency, define the target group conditions for the ESQ to be issued based on their trip patterns (e.g. time, distance) by selecting appropriate rules (and, or, not) and then defining the conditions according to which this particular ESQ should be issued. As early testing proved it to be hard to set up an ESQ correctly, use of this functionality has been limited.

Trip page
The trip page gives the Living Lab Co-ordinator access to all trips in the Living Lab (csv-style). Using the trip page, the activity of users can be monitored (and users could be reminded of their participation). This data is also used to select users for the experimental groups, to define Enschede-specific peak hours, and to do the evaluation work.

Trip viewer
This tool proved especially valuable in solving issues reported by users. The Living Lab Co-ordinator has in-depth access to trip measurements (map-style). As the tool gives in-depth insight to users trips, detailed feedback can be given. For example, in the case where a user who saw a wrong route displayed, the analysis showed that only an origin and destination were recorded and the route was a best guess, which the user interpreted as a failure.

As the Living Lab Co-ordinator sees a lot of data for a user, it felt sometimes a bit discomforting. For example, to see a midnight pub visit by a user. Whilst it is a good debugging tool, it would be recommended that access to tools of this type is limited as much as possible.
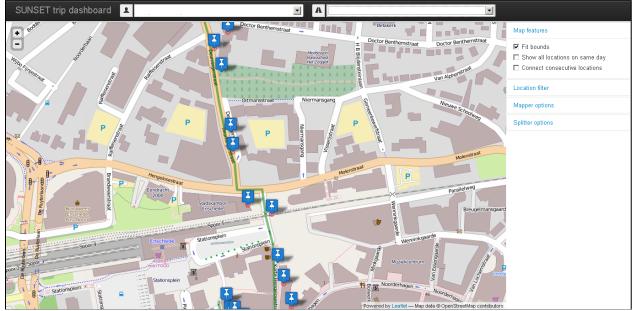

Figure 5-4: Trip viewer

SPS Map-page
The SPS Map-page has some overlap with the tripviewer, but is limited in the level of detail (measurement points are not shown individually). An additional feature is the reading of the battery level (figure 5-5), which was very useful in providing feedback to users.
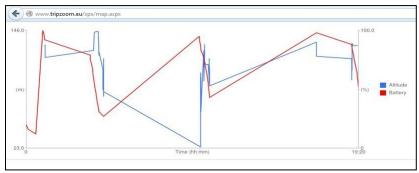

Figure 5-5: Insight in battery usage

ESQ log and IMP log
These two log pages give insights to the answers provided by users to ESQ's and the points rewarded for the incentives. They have been used to monitor the experiments, to support the evaluation and to determine winners in a points competition.

Questionnaire engines
Different questionnaire engines (Lime Survey, Netigate, Bristol On-line Survey) where used to carry out the pre- and post-questionnaires. As localisation was needed for all of these questionnaires, the local best available option was chosen as a tool. Using either e-mail addresses or specific tokens, questionnaires could be matched to actual tripzoom users.

5.3 Retention activities

Despite having a low number of active users in the Leeds Living Lab, it is worth referring to the retention activities to reflect on the approach implemented and offer feedback for future research.

During previous activities in Leeds e.g. WP3 focus groups or on-line survey (Table 2-2), compensation was offered to participants. However an informed decision was taken not to offer financial reward during the conduct of this stage of the Leeds Living Lab. This had a mixed outcome since some users who had previously expressed some interest in the SUNSET concept expressed their interest in participating in the Leeds Living Lab too, assuming that there would be some type of financial reward. This is demonstrated by the following statement:

> *Hi there, I am interested in taking part in the project to win £20.*
> *Can you give me some more details?*
> 2nd October 2013 by e-mail

The decision in Leeds was to focus more on large employers located in the city centre to ensure some spatial and social synergies (Figure 4-2). The response from large employers located within the city centre (e.g. Leeds City Council), was lower compared to the WP3 invitation to join the on-line survey. In the WP3 work, 93 participants completed the survey receiving £15 for their time and travel costs. This also resulted in some on-line survey participants asking for clarification on

whether any compensation was offered this time and led them to not join as a result. A potential explanation is that participants of the WP3 survey were requested to offer 30 minutes of their time, whereas participation in the actual Leeds Living Lab were asked for a more significant time commitment of about one month. Some users who expressed interest stated afterwards that despite their willingness to join the Living Lab, they could not do so since they had to travel frequently outside Leeds – and the tripzoom area –due to work commitments.

After assessing the user feedback and balancing the positive and negative implications of offering financial reward, a compensation of £20 was offered to participants from one HEI. This decision was taken to ensure some spatial concentration in addition to those who would be recruited through Facebook in order to support the SUNSET social networks objective. A clear advantage of this approach was that users may have been enticed to join, particularly as there were no other tangible rewards offered in contrast to the scenarios outlined in D5.3. There was a risk though that this reward may result in:

1. high Living Lab costs
2. attracting users solely interested for the reward instead of any of the SUNSET objectives

In practice, only two registered users received compensation as the arrangement was that users would only receive compensation if they remained active until the end of the Living Lab. Users' motivations were not actually assessed prior to joining the Living Lab, but it was assumed that informing them about the SUNSET objectives would offer them a good understanding of the anticipated aims and outcomes of this Living Lab. Noticeably, some users decided not to participate in the whole duration of the Living Lab despite the £20 compensation offered. That may have been influenced by the rescheduling of some activities by the SUNSET team due to tripzoom related technical uncertainties.

Several attempts were made to increase interaction of users in Leeds with the Leeds tripzoom Facebook page as part of the preparations of the Leeds Living Lab (Table 2-2) by posting local news and material about relevant initiatives earlier in 2013 (Figure 5-6). This task included the:

- collection of relevant information and initiatives in Leeds
- identification of the key relevant details
- alignment with the Leeds Living Lab timeplan
- posts and invitations to other Facebook user groups
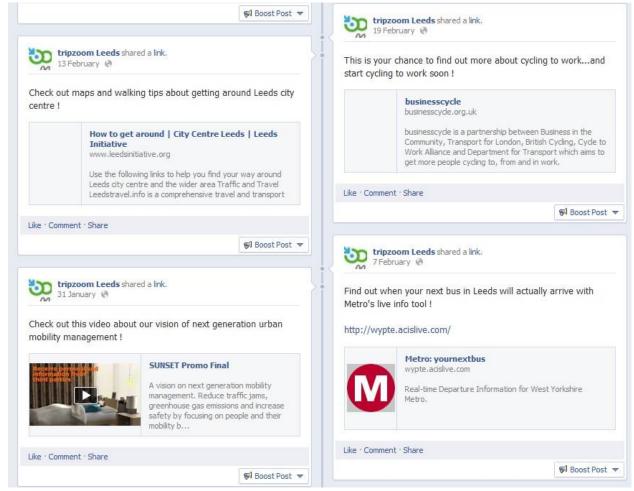- daily monitoring of the page

Figure 5-6: Examples of local news, updates and links posted on the Leeds tripzoom Facebook page to generate interest during the preparations for the Leeds Living Lab.

As Lampe et al (2012) have reported though *"a number of demographic and usage behavior differences exist between those who choose to engage in information-seeking behaviors on Facebook and those who do not"*. Consequently, the user groups targeted in Leeds (outlined in D1.1, D5.3 and D7.1) were underrepresented among local Facebook users, as experience proved in this Living Lab. Nonetheless, several of those targeted users did view a post or update of the Leeds tripzoom Facebook page during the Leeds Living Lab in October and November 2013 (Figure 5-7).
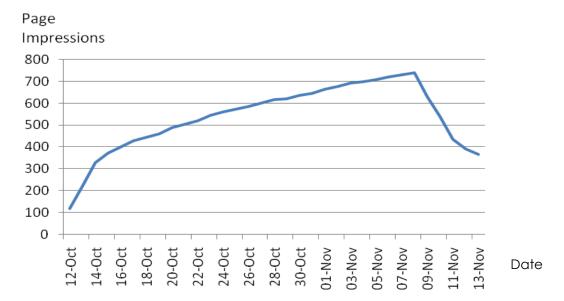
Figure 5-7: Monthly total impressions of stories published by a friend about the Leeds tripzoom Facebook page by story type.

As a summary, Table 5-1 outlines the features of the use of Facebook for recruitment and retainment campaigns which may confirm certain aspects (e.g. quick access to certain types of users) whilst rejecting others (e.g. low cost and time needed), in contrast to Bhutta (2012).

Table 5.1: Pros and Cons of using Facebook to recruit and retain participants

Pros	Cons
• Quick access to a large/diverse pool of users	• Time needed to monitor/update page
• Target specific features (location, gender, age)	• Facebook technical limitations e.g. reward
• Low cost (if no paid ad campaign is used)	• High cost (if paid ad campaign is used)
• Access to some otherwise inaccessible users	• Ability to handle negative comments/publicity

In general, the users who remained active in the Living Lab were the ones who communicated well by e-mail. As this was the major communication channel used in Leeds, the Living Lab Co-ordinator circulated updates about each phase, but also informed users about small tasks, namely the need to complete the on-line questionnaire and respond to ESQs. Active users engaged well through this communication channel which was supported by some limited telephone communication too. Retention activities in Leeds were concluded by inviting users to offer feedback about their experience with tripzoom and with the receipt of the compensation reward.

5.4 Helpdesk & Feedback

Aside from the alternative channels used, (i.e. face to face communication, telephone, post or Facebook), the majority of feedback and helpdesk support were provided via e-mail and the specific SUNSET account used in Leeds. The following are examples of such queries indicating the need for further assistance to users:

> *I am interested in signing up to test the trip zoom app. Could you give me some more information?*
>
> 27th September 2013 by e-mail

> *Hi, I'm interested so please can you send me some more details?*
>
> 27th September, 2013 by e-mail

User queries fall within the following broad categories:

- registration
- survey objectives / duration
- technical requirements
- compensation offered
- battery usage

Due to the registration procedure implemented in Leeds, the initial invitation asked users to confirm by e-mail that they:

- travel in Leeds
- use a smartphone
- are over 18 years old

Following confirmation that they had to return the signed consent form and then download and register with tripzoom, users were then informed that this was a 'beta' version of tripzoom and that it could take up to 48 hours for them to receive their tripzoom account activation e-mail. This stage proved challenging during the technical trial (Table 2-2) and it was anticipated that some users could face difficulties with registration (which was indeed the case). However, the Living Lab Co-ordinator was prepared for such occasions and tried to managed challenges and user expectations to retain user interest. The steps below are based on a thorough review of this issue by DOCOMO and other SUNSET members of the technical support team to outline the steps followed by a single user in Leeds trying to register with tripzoom:

1. the user registered with a given e-mail address but could not log in immediately because his registration was not activated yet as he was not assigned to a Living Lab
2. the user tried registering again immediately using a different username but the same e-mail address which is not allowed
3. the user tried registering again using the same user name but a different e-mail address, but mistyped the e-mail address which the system detected
4. the user then tried to proceed using the 'Forgot my password' option using his full name as a user name, but the system could not find such a user name as it did not exist
5. the user then tried again to register using the first username and e-mail address, so the system then stated that this account already exists
6. since the system stated that this account already exists, the user tried to log in again using those details and failed to log in again (as his account was not yet activated)

7. the user tried registering again using the same user name but a different e-mail address which was spelt correctly this time, but the system did not allow him to log in since that username already existed
8. the user gave up, but tried again a few hours later to fail once more to log in

As a result of those unsuccessful attempts to register and log in, this user decided not to progress any more in attempting to join tripzoom and gave up after these unsuccessful attempts. Fortunately he did inform the Leeds SUNSET team about the difficulties he faced:

> *I have downloaded the app. However despite numerous attempts using two email addresses, it has proved impossible to progress any further. Therefore I cannot participate in the project. Regards*
>
> 30th November 2013 by e-mail

which resulted in his account being activated and him registering successfully after three days.

> *I have tried a hundred times to register on the tripzoom app on my smart phone and cannot get access, originally a message came up asking me to register via email as it couldn't perform my request. Since then I have tried to set up my account and some of the details must have saved somewhere because I then tried to amend some details but kept the same email address and it came back with 'this user already exists', however when I try to log in using the details I originally put in it says put in a valid username. I'm afraid I can't win at the moment, is there a help desk or technical support team I can contact?*
>
> 2nd December 2013 by e-mail

The previous comments highlight that the provision of accurate information and managing expectations constitute indispensable components of a Living Lab, so appropriate time and resources should be devoted to those tasks, even outside normal working hours. Providing a seamless registration process is of paramount importance as the first impression of tripzoom to users appears to have had a disproportionate impact on their decision to join the Living Lab or not.

For those users who managed to register successfully, tripzoom turned out to be a positive and intriguing experience, at least at the beginning. This was mainly during the first two weeks which were used as the user familiarisation and mobility profile building period. These users explored tripzoom functionality and asked for guidance regarding survey requirements and tripzoom interaction. They also pointed out some technical deficiencies:

> *Hi, I have been using the app for a few days now and, on the whole, things are going well. However, one 'snag' that I have noticed is that the app is frequently logging me out and therefore missing some of my trips, which include those made on foot and in the car. Do you know of a way to address this? Are prompts on the more specific details of what we need to do sent out via e-mail or via the app? Or is it just a case of leaving it up and running?*

3rd October 2013 by e-mail

> *My initial feedback regarding tripzoom, acknowledging that this is a new app and has quite a few bugs:*
>
> > *1) looking at the division of transport, I would suggest dividing by mileage rather than time (or in addition to?)*
> > *2) overall an interesting concept that I think will be more appealing when it works correctly*
> > *3) there is no way to manually add a trip when the system doesn't pick up your commute. Most of my train travel seems to not have been picked up.*
> > *4) the system logs you out randomly and therefore doesn't log while not signed in*
> > *5) the system doesn't recognize 'legs' of a journey, e.g. My trip to work is generally recorded as one journey w/ one form of transport where as it's actually 1.5 miles on foot, 10 miles by train.*

30th September 2013 by e-mail

Trip detection accuracy has been an issue analysed elsewhere in SUNSET (WP5 and D7.5), but it appeared to have been a significant feature for several users. This issue had two dimensions i.e. missing some trips completely or missing certain parts of some trips. It was also context specific as Leeds city centre has some high rise buildings which reduced the accuracy of location detection. Trip combination, trip partition or trip addition were also highlighted by users as functionalities which need to be improved in the future. Moreover, battery usage and data download needs were raised as concerns from users, particularly in the pre-registration stage due to the smartphone battery drainage concerns and potential costs incurred.

User queries revolved around ways to overcome these issues during the Living Lab. The Living Lab Co-ordinator provided information to users and advised them that such improvements could not take place during the Leeds Living Lab, but that their feedback was particularly useful for this research project and their contribution had been acknowledged.

No major issues were reported regarding the on-line questionnaire used in the Leeds Living Lab. The sole concern raised was about the absence of a 'not applicable' or 'not willing to travel' option at the questions linked with travelling outside peak traffic times:

> *I completed the questionnaire this evening. Question 31 related to willingness to commute later in the day if your employer allowed. There is no option to register a complete unwillingness to travel, but completion of the question is forced and I could only limit my answer to the minimum level. This is an error biasing the result of the questionnaire.*
>
> 16th October 2013 by e-mail

Finally, no major concerns about the privacy consent opt-in requirement were reported by those users who registered for the tripzoom survey in Leeds. This may be interpreted either as an absence of any major concern of users about this issue or as an absence of those users who were concerned from the tripzoom survey in Leeds. It is therefore useful to review this concern in tandem with the findings reported by the two other SUNSET Living Labs.

5.5 Lessons learnt

In summary, the interaction with users within the Leeds Living Lab and the user retention activities confirmed the issues highlighted in chapter 4 about user recruitment. The following recommendations from Leeds may offer important insights for other similar Living Labs in the future:

- first impressions are important and can have a disproportionate effect
- registration should be as seamless as possible - users expect to immediately "click and use"
- user expectations should be explained from the outset and managed continuously
- support and a helpdesk may be required 24/7
- Facebook can prove a useful communication channel to access potential participants quickly and cost-effectively, according to specific criteria
- Facebook may also prove costly, time consuming and pose technical challenges, so conventional communication channels e.g. e-mail may be also used
- social media advertising does not necessarily ensure a good conversion rate to actual users

These comments highlight that the provision of accurate information and management of expectations constitute indispensable components of a Living Lab, so appropriate time and resources should be devoted to those tasks, even outside normal working hours. The provision of a seamless registration process is also important as the first impression of tripzoom to users appears to have had a disproportionate impact on their decision to join the Living Lab or not.

6. Implementing the Living Lab

The process of implementing tripzoom in the Leeds Living Lab generated further knowledge and recommendations for establishing Living Lab experiments in a wider context. The process and the main points emerging are presented in this chapter. A mixed-methods research approach was taken overall comprising three stages: a) trialling automatic data collection via tripzoom mobility monitoring, b) qualitative data collection using focus groups and c) structured quantitative data collection through questionnaires. As a result the Leeds Living Lab developed into a Broad Spectrum Lab, in comparison with the very specific focus of the other two Living Labs. The rationale and main advantages of this mixed – methods approach can be summarised as follows:

- The first stage of the Leeds Living Lab involved testing a set of common processes to Enschede and Gothenburg – these included recruitment, registration, retention and automatic data collection for evaluation. As a result it has been possible for the research as a whole to abstract on these issues across three different geographic contexts, i.e. in terms of transport infrastructure, economy and culture. The overall benefit was the ability to generate early findings on questions such as how specific (or generalizable), the Living Lab challenges, experiences and knowledge generated are.

- The second stage departed from the approach taken in Enschede or Gothenburg and used a purely qualitative research method. This involved focus groups with participants comprising members of the travelling public who were also users of a range of smartphone applications. This second stage allowed the collection of data that was not directly linked to the tripzoom application. It was therefore able to explore underlying perceptions, values, behaviours and stated preferences in a more objective way than was possible with a single piece of software as the focus. The advantage of this research route and the data generated was the ability to address a wider set of questions of relevance to the longer term trajectory for applications such as tripzoom.

- The third stage of the Leeds Living Lab was conducted in tandem with the focus groups, using the same recruited cohort and involved supervised questionnaires to generate quantitative data. The questionnaire was also designed to explore underlying values, perceptions and preferences without being specifically linked to the features or perceptions of tripzoom. The structured nature of the questionnaire and the quantitative outputs were intended to be complementary to the freeform and more spontaneous nature of data collected in the directed group conversations. The questionnaire data was also collected on an individual basis rather than within the context of a shared (open) discussion. The advantages of generating a combined qualitative and quantitative dataset from the same cohort are numerous. However a main benefit is the ability to generate quantitative analysis and projections related to the wider uptake of apps that include mobility monitoring and sharing through social networks

In summary, the Leeds Living Lab adopted a different format to the Enschede and Gothenburg labs, which were both heavily focused around the tripzoom application and collecting mobility data. This had the advantage that the SUNSET research as a whole was able to generate an additional set of insights related to the wider factors likely to influence the success or otherwise of tripzoom-type software. The main findings concerning implementation of stage 1 of the Leeds Living Lab are described below, with an overview of the process involved in implementing stage 2 and stage 3. The research outcomes from the focus groups and questionnaire are

incorporated in Deliverable D7.5, which also includes the outcomes from the Enschede and Gothenburg Living Lab.

6.1 Implementation issues for stage 1

This section focuses on the challenges faced in the first stage of the implementation of the Leeds Living Lab i.e through the trial implementation of the tripzoom software. Issues in recruitment and retention have been described in previous chapters. The challenges raised and the way they may be addressed provides input for chapter 8. Whilst the first stage of the Leeds Living Lab involved around 40 users overall at different stages of the research, only a small cohort (less than 10) were using the software with their daily travel at any point in time. This had the advantage that the Leeds Living Lab Coordinator was able to communicate on an individual basis with users, generating useful qualitative outputs concerning user experiences. However the disadvantage was that the volume of mobility data generated was not appropriate for a rigorous quantitative analysis.

The design of the reward system in the Leeds Living Lab was such that a range of incentives were given to users to join the Leeds Living Lab, rather than offering tangible rewards through use of tripzoom. This design addressed potential issues around taxation and accounting that may have arisen with an alternative reward system. It also had the benefit of minimising opportunities for user dissatisfaction if errors occurred in allocating rewards with a monetary or other high value reward.

A key element of the Leeds Living Lab (as discussed in D7.1 and chapter 4 of this deliverable) was the spatial concentration of users. By focusing on specific spatial areas (or employers) it was possible to offer users the option to join a community of others travelling to the same destination. This offered the possibility to share experiences and concerns with other travellers. In addition, tripzoom users had the option to review basic trip information both through their smartphone and through the tripzoom portal. However, overall the portal option was not exploited by users in the Leeds Living Lab.

It was not the intention of the Living Lab Coordinator to offer users an explicit overview of SUNSET objectives as this could bias their behaviour (Gustarini et al, 2013). To allow users to become familiar with the basic functionality, an introductory time of two weeks was used before incentives would be issued. This also allowed the application to start building a mobility profile based on their weekly travel pattern. At the same time, the pre-questionnaire was forwarded to users by e-mail, along with a series of Experience Sampling Questions (ESQs). ESQs were launched five times per day for two weeks, asking about:

- Ease to use tripzoom
- The usefulness of tripzoom features
- Safety from car accidents during that morning's journey
- Safety from anti-social behavior during that morning's journey
- Level of their overall contentment on that given day

Gustarini et al (2013) raised some further issues for the implementation of Living Labs. Not all of them are relevant to SUNSET though, so only those relevant to the Leeds Living Lab are commented on here. The qualitative findings from the tripzoom users engaged in the mobility monitoring and ESQ stages of implementation are summarised below.

6.2 User Feedback

Privacy issues were not reported as a significant issue by any of the users in the first stage of the Leeds Living Lab. It was, however, a very significant issue emerging in stage 2 and 3 i.e in the focus groups and questionnaires in the subsequent implementation stages (see Deliverable D7.5). This could be the case if either participating users did not have any privacy issues, or because tripzoom offered adequate control to users through the in-built privacy settings. Users also had the option to switch off tripzoom if they decided that they did not want a particular trip recorded.

No user 'cheating' was reported in the Leeds Living Lab and this may be a benefit of the design i.e. no tangible reward was offered to users linked with their travel behaviour. This may not have been the case if the design had been such that tripzoom points could be exchanged with tangible rewards as has been the case in Enschede.

> *In general, I found the app easy to use and helpful. I particularly liked the average journey time information. However, I did find some glitches as you would expect with a beta version app, which I believe this one is at the moment. For example, there appeared to be some conflict between the app and Google maps which caused one or both of the apps to crash while in use. In addition, when trying to confirm journeys and/or change the reason or journeys, for example, the information often didn't appear to record or the app crashed when trying to do so. The app recorded the majority of my journeys that I took by car but didn't include most of the ones that I took by foot. Perhaps this is due to a lack of signal but I often took journeys on foot in areas that were recorded when I travelled by car.*
>
> 19th November 2013 by e-mail

Users were aware that tripzoom is an alpha version so they did not make any major performance related complaints about glitches, yet they reported issues and made constructive suggestions to fix tripzoom bugs. Registration queries requiring the Living Lab Coordinator's attention still appeared but were of low importance:

> *Hello and thank you for your quick response and the update. This message is actually optional, so it is not essential to e-mail leeds@tripzoom.eu. You should have just a message from tripzoom. So please look for a message from @tripzoom.eu (check out your Spam folder too please) including the activation web-link. Let me know in case you need more assistance.*
>
> LLC response: 23rd October 2013 by e-mail

However, certain features of tripzoom in Leeds were not straightforward, totally accurate or informative for users which triggered communication with the Living Lab Coordinator for clarifications:

> *Whilst I welcome the research, I found it useless in affecting my*

pattern of travel. This was simply because I found the info provided by the app was so inaccurate that I ignored it. The only accurate aspect of it was the ability to track the actual journey on a map more often than not. Most of the time anyway, because there were some glaring mistakes there too. The default figures used for fuel consumption / economy and CO_2 figures were wildly inaccurate and totally unsuitable for small cars, and I suspect would be for anything less than the size of high end luxury cars, e.g. Jaguars, BMW X5s, Porsche Cayenne's, or other so called 'Chelsea Tractors'!! So, in the end I don't believe the research could possibly be accurate for the majority of drivers, unless you were targeting luxury/transport drivers. App beta version or not - nice idea, but in the end badly implemented. I wouldn't trust the data you received.

6th November 2013 by e-mail

Hi,
this is the kind of feedback that is really useful for us so keep it coming!
Actually the pence per mile cost is of course approximate, but is based on the full cost of motoring per mile eg when you bring in things like vehicle tax, some rough insurance costs etc. We have some guidelines on the appropriate figure from long term research.
Your suggestion on putting in the actual vehicle type etc is something we looked at too so thanks for that. We have tried to balance the effort needed by people using the system and felt we may be asking for too much detail. It is something that could go into a next version.
On the carbon cost, this is again approximate but based on published EU research data. It would of course be more accurate to use figures for your specific vehicle.
I will pass these comments on to the team and thanks again.

LLC response: 25th October 2013 by e-mail

No problems, just curiosity (killed the cat probably);-
Been using the app for a couple of days now, so have some 'trips' on it, and I noticed the app gives you a cost figure and CO_2 figure. I'd be curious to know on what basis these figures are calculated, because they bear no resemblance whatsoever to even the longest of trips I've made so far. i.e. There is no way (or is there?) to enter the type of vehicle you might use and how economical (or not) it is, e.g. a 50 mile car journey that I know only costs 10p a mile in fuel is shown as three to four times that,

6.3 Implementation issues for Stage 2 and 3

The subsequent implementation of the Leeds Living Lab involved the use of focus groups and quantitative questionnaires. A summary of the steps taken to recruit participants to these is described below.

A total of 72 participants were recruited using a professional recruiting service. For this stage of the Living Lab it was important to obtain a sample of members of the public that met a particular set of criteria, rather than being recruited randomly. Hence the use of the professional service that was able to work efficiently within the remit set. In order to again fulfil the ethical requirements of the University of Leeds, a further request for ethical approval concerning the arrangements for the focus groups and questionnaires was made and granted.

The remit provided to the professional recruiter was to obtain 72 participants that would be available on one of six evenings in late November/early December and who were able to attend a focus group session at the University offices. The groups were to be roughly balanced by gender, distributed by age, all over the age of 18 and all should use a smartphone. The participants should also be residents of the Leeds City region, which was determined by the LS prefix to their home postcode. Examples of smartphone brands were provided based on 'most popular' lists produced by several service providers. Further information on this can be found in Deliverable D7.5.

Occupational screening was also undertaken with the goal to avoid participation by the following groups:

1) Anyone employed at the University of Leeds (although employees of the nearby Leeds Metropolitan University were allowed)
2) Employees of phone service providers (apple, blackberry, Nokia etc)
3) Those employed in phone retail (dixons/currys, O2, vodophone etc)

However employees in general stores that also sell phones but aren't specialised were allowed. For example the large chain of 'Argos' outlets sell phones but someone who works in the store would not necessarily be a phone specialist. Others working in technology more generally were also allowed, for example people who work with computers, laptops etc. The professional recruiter obtained the participants over a period of approximately two weeks prior to 24th Nov. Members of the public were approached by the recruiter at locations deemed to be 'neutral' in terms of the socio-economic characteristics of people likely to be circulating. A minimum age of 18 was stipulated and all participants were offered a sum of £30 (to be paid on the evening) to compensate for inconvenience and travel. In addition, the recruiter was reimbursed the sum of £15 per person who attended on the evening. If a person did not attend then no payment was made.

The recruiter maintained contact with the participants by telephone from the time at which they agreed to participate. Checks were made shortly before the evening that they were still

available to take part. A very small number (around 5) dropped out and the recruiter worked to obtain a substitute with a similarly acceptable profile. The recruiter also attended on the evening of the focus group itself to assist by phone or in person with participants that were delayed or seeking directions. Overall the use of a professional recruiter proved exceptionally good value in terms of return for the financial cost. A full cohort of participants was successfully obtained using this method and the subsequent stages of the Leeds Living Lab were able to generate high quality datasets (qualitative and quantitative) for analysis. Further details on the technical content of the focus groups and questionnaires, together with analysis of their content are given in Chapter 6 of D7.5.

6.4 Lessons Learnt and good practice

Some useful lessons emerged from the implementation of the Leeds Living Lab. The first stage of the Living Lab had some commonalities with the labs in Enschede and Gothenburg, hence some of the lessons supplement the findings from those Living Labs. The subsequent stages departed into a different approach and therefore generated lessons that related to the Leeds Living Lab only. A summary is as follows:

- There are members of the travelling public willing to act as users of the system and share their mobility data, but they need to be aware of the broad research objectives
- An introductory period is useful for users to familiarise themselves with the Living Lab context and the basic features of the software
- The Living Lab Coordinator should be alert for signs of abnormal behaviour by user and intervene accordingly
- A Helpdesk and FAQ option are needed for users in order to resolve any technical difficulties and provide up to date information about the research project
- Users drawn from the general public (rather than students or fellow academic) are willing to accept the preliminary status of software they may be testing, but still have high expectations overall in terms of performance and accuracy
- The use of a professional recruiter is cost effective and can result in a set of participants who are aligned with a set of pre-established criteria
- Participants for focus groups expect financial compensation for inconvenience and travel. Whilst this is not a negligible sum, especially for a larger cohort overall, this results in a high volume and quality data
- The mixed methods approach taken in the second two stages of the Living Lab generated a database of mixed quantitative and qualitative outputs. This was important in enabling the understanding of wider factors for success for a tripzoom type application

As a final note, the implementation of the Leeds Living Lab took place within the context that the tripzoom software was finalised and no further design loops or amendments were feasible. Many of the points raised by users at the operational stage contained useful suggestions and potential corrections. With an extended software development phase these may have been incorporated or the software corrected for the benefit of subsequent users of the system.

7. SWOT analysis of the Leeds Living Lab

This chapter summarises the findings presented in the 'lessons learnt' sections of the previous chapters and conducts a SWOT (Strengths – Weaknesses – Opportunities – Threats) analysis. The main purpose of this analysis is to synthesise and to stress the transferable knowledge derived through the Leeds Living Lab. In a multi-stakeholder context it is possible for the SWOT analysis to be different according to different perspectives. Here the SWOT analysis is undertaken from the perspective of a Living Lab Co-ordinator, the main objective being to offer valuable insights for similar research exercises in the future.

7.1 Strengths

- The 'Living Lab' approach in general allows the collection of a large volume of primary user data either automatically or semi-automatically. This a particular strength compared with some more conventional research methods (for example, roadside surveys).

- The process of taking a Living Lab through to implementation in this research has provided proof of concept that there are users who are willing to share their mobility patterns. Further research outcomes on this point are given in Deliverable D7.5.

- The city of Leeds is fairly representative of larger cities in the UK in terms of the level of ICT infrastructure available. Demonstrating the technical feasibility (and future challenges) in introducing software such as tripzoom in this context (rather than in a 'supercity' such as London) is an important outcome.

- The project as a whole and Leeds Living Lab in particular has designed and implemented a strong ethical framework within which similar experiments of this type could be conducted in future. This has fulfilled the national and international legal requirements and the institutional requirements of the partner organisations.

- The increasing role of pervasive technologies and ICT in transport is highlighting the need for a new set of skills for staff at various levels in the sector. The research has identified that a particular set of skills are needed for a Living Lab Co-odinator to design, implement and assess a successful Living Lab.

- Social networking has been at the heart of the SUNSET research. This has been articulated through various features in tripzoom, the methods of recruitment, the research methods for qualitative data and dissemination processes. Through this it has been possible to explore the boundaries of media such as Facebook and identify social media capabilities. Specific research outcomes concerning social networking are also reported in Deliverable D7.5.

- The dynamic nature of the qualitative tripzoom related research (e.g. various stakeholder meetings and focus groups) has highlighted the need to anticipate and be prepared for various pathways through the related discourse. These may also require the development of different communication formats and presentation interfaces as a result of the highly individual socio-technical issues.

- The software is not only dynamic but includes a facility for direct communication between the public and Living Lab Coordinator. This has highlighted the need for fast and accurate communication and information provision to users, and that a high level of service is essential for success.

- The tripzoom implementation, communication process and assessment needs have all contributed to the development of various Living Lab Coordinator tools. The design and implementation of these tools has generated knowledge for important features in a future system, such as Helpdesk & Feedback activities.

- The simultaneous and collaborative launch of three Living Labs has illustrated how 'cross-border' cooperation and management of such Living Labs is possible within a single system overall. This is an important finding for wider implementation of schemes that may be corridor in nature or cross existing governance boundaries. This approach has also demonstrated how collaborative Living Lab working can enhance user experience through diverse activities

- It was found that a small but immediate monetary compensation for inconvenience plays a role in successfully recruiting participants to the Living Lab. In general it is preferable to have participants who wish to take part on the basis of interest in the research, however a small payment recognises that their contribution may be at some personal cost.

- The operational phases of the Leeds Living Lab have demonstrated the effectiveness and value for money in working with a professional recruiter to obtain a cohort with a specific profile. Whilst payments to both the participants and the professional service were needed, the process was extremely effective in recruiting the number and profile of participants stipulated.

- The mixed methods approach taken in the second two operational stages of the Leeds Living Lab generated a database of mixed quantitative and qualitative outputs. This was important in enabling the understanding of wider factors for success for a tripzoom type application.

- Any future business model for a tripzoom type scheme is likely to include a range of stakeholders. The research overall has created awareness and knowledge of the perspectives, priorities, needs and restrictions of a range of stakeholders including local authorities or transport operators

7.2 Weaknesses

- The SUNSET project had a number of research objectives whilst the tripzoom software contains a relatively high number of features and functionalities. We noted the success of other 'single focus' applications, such as those designed to generate transport related health benefits. Following feedback from users a recommendation has emerged that future software of this type should have a single focus/objective.

- In terms of research methodology, the current economic climate is one where research participants generally expect a financial reward for inconvenience and expenses. As user-testing is an important part of the design and implementation loop (and a strong

cohort of testers is highly desirable), this expense should be factored into the experimental process.

- One of the strengths of the research has been the evaluation of interfaces with existing social media (i.e. Facebook). However this task involved engagement with commercial software and therefore a necessary commitment of financial resources to test under an experimental regime. The level of financial draw involved may not be desirable or available to future researchers.

- A further innovation of the project has been in establishing some robust and ethical examples of data protection and management processes for a Living Lab. Due to the innovative nature of the process, few templates and established protocols were in place. Future research and implementations may be better served in this respect as the research base becomes established. However currently, there should be an awareness of the potential need for detailed preparation and repeated Living Lab rescheduling.

- Establishing provenance for a new piece of software through association with established stakeholders and organisations may be necessary to build trust with users. In general the level of trust with a new product can be fragile and the belief that established, well known and reputable organisations are associated with the product may help strengthen trust.

- In order to ensure all steps had been taken to safeguard individuals (e.g. in terms of their personal data and possible vulnerabilities), a multistage registration process was used. Following user feedback and retention issues it became clear that a one-step seamless registration procedure (e.g. consent form stage) would have been highly desirable from the user-experience perspective.

- The definition of user groups through the City Dashboard is an important task which would ideally be based on accurate travel information (i.e in grouping together individuals with similar travel characteristics). Collecting this information at the outset creates an addition burden e.g. at registration for the user. However without the information the definition of user groups maybe sub-optimal from the Living Lab Coordinator perspective.

- In line with previous research in the broader social media context, the Leeds Living Lab found that the time requirement for engagement by the Living Lab Cordinator is significant e.g. the time required to design, manage and monitor social media interaction. This is an important implementation issue, however it is one which will only be resolved by further substantive research and possibly ethos change.

- Inevitably with a prototype, technical difficulties arise and a number became apparent with tripzoom e.g. system instability, inaccuracies at trip start or regarding cost estimates required long and repeated testing periods which need to be incorporated in the initial plan. However the advantage in having identified these technical difficulties is they potentially set the agenda for future research efforts in the field.

- With some commercial or near market products a highly desirable 'viral' effect has been seen and this was not the case with tripzoom. However in view of the multistage registration process (implemented to safeguard individuals privacy and personal security) it may not have been expected.

7.3 Opportunities

- Having a seamless registration process would create a positive first impression with a lasting impact. Offering alternative registration channels may have a similar outcome. The registration process as a whole is an area with potential, particularly if the balance between privacy/security/ethics and positive user experience can be resolved.

- Providing accurate information to users e.g. about real time traffic conditions or trip CO_2 emissions can improve user experience and engagement. The system could be further enhanced by the provision of this more accurate and potentially bespoke data.

- User expectations can be managed well where objectives are clear and communication protocols/content are strong and nuanced from the outset. Further developments to the reward policy and ensuring frequent communication in engaging language would be one way to facilitate this

- Social media can be used to access a large and diverse pool of spatially dispersed participants using a variety of features. As the research basis becomes increasingly established, the pool of experience in designing, collating and managing material should be beneficial in terms of saving time and other resources

- Where it is feasible to offer high levels of service such as a 24/7 helpdesk (by e-mail or social media) for technical support, this is likely to increase user trust and participation, resulting in higher retention and improved data quality over time.

- Opportunities to share some types of costs, raise the profile and awareness of Living Lab experiments can arise through co-ordinated actions with other Living Lab Corodinator and local stakeholders

- Whilst bespoke data protection and management processes were developed in this project, the opportunity exists to further develop these to transferable processes with wider benefit.

7.4 Threats

- The timing of a Living Lab should be carefully planned but incorporate sufficient flexibility to deal with the number of uncertainties and the iterative design loop.

- Social media may prove a resource intensive process in time and financial commitment due to relatively low conversion rates. Progress monitoring and dynamic responses can serve to mitigate some of these costs.

- In line with outcomes from other social media research, an important finding is the need for constant monitoring to avoid negative publicity. The first user impression counts disproportionally to the whole.

- User participation and retention rates may be impacted by the level of wider stakeholder engagement e.g. third parties. These can serve to lend credibility and provenance to the initiative. As a reference lab that involved a mixed-methods approach to the

research, the design of the Leeds did not finally incorporate stakeholder participation. However the opportunity to increase user participation and retention through greater involvement of strategic local stakeholders (i.e. local council, large employers, transport operator) exists.

- Technical problems which often arise with prototype software but remain unresolved during a Living Lab can have a significant impact on user experience and participation. This may be addressed by planning further cycles of re-design into the lab implementation overall.

- A stable and reliable GPS tracking system is required to be able to provide accurate data, properly targeted challenges and to avoid discrepancies. However part of the success in the research overall has been in identifying significant (and less significant issues) of this type for the forward agenda.

In summary, the SWOT analysis has highlighted a range of issues, some of which might be expected with any new software trial implementation and many arising from the complexity of the interface between technology and humans. The added value of the SWOT analysis reported here is in reporting those issues and opportunities arising from the more novel and complex nature of the tripzoom system, i.e the dynamic interaction with the Living Lab Coordinator and the multiple features comprising mobility monitoring, incentives and social media. We see these as valuable outcomes that contribute to the forward research agenda for future projects in this field.

8 Commonalities & differences between Living Labs

The SUNSET approach with three distinct Living Labs in three European countries (Figure 8.1), which were designed in close collaboration and operated as one full Living Lab in Enschede and two reference Living Labs in Gothenburg and Leeds, has resulted in valuable findings.
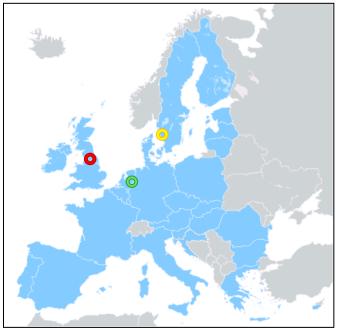

Figure 8-1: The location of the Living Labs (Enschede, Green; Leeds, Red; Gothenburg, Yellow)

The Living Lab reports D7.2 (Enschede), D7.3 (Leeds) and D7.4 (Gothenburg) describe the process for designing and operating the three different SUNSET project Living Lab. As, there were both commonalities and differences between Enschede, Leeds and Gothenburg we bring together the lessons learnt and draw some comparison in this final chapter. The three Living Labs are compared on four aspects (Figure 8-). This Chapter is therefore the same over the three deliverables.
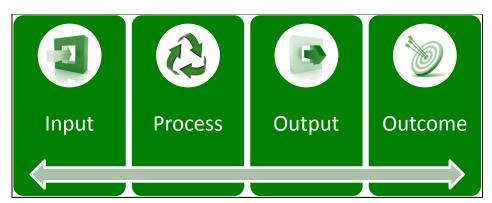

Figure 8-2: Living Lab comparison aspects

The comparison is primarily an analysis to identify the processes and resources needed to successfully operate the different Living Labs with the aim of providing the transport and ICT

sector communities with insight and knowledge of the design and operation issues. Output form the Living Labs is described in D7.5.

8.1 Input

The input towards the Living Labs is based on the Living Lab Plan (SUNSET Deliverable 7.1). The context of all the Living Labs is an urban area where there is a congestion problem and governments are more and more looking for novel solutions. SUNSET developed the tripzoom system as one such solution. In the Living Labs, the main innovations of social networking services, personalisation, incentives and the tripzoom system are the main tool used as input.

Table 8-1 gives an overview of the activities that took place in the three different Living Labs. All labs had a similar preparation and pre-operation stage. During the operation stage, choices were made based on differences between the labs and the sharing of experiences. This approach allowed the use of three different Labs for testing of a wide variety of aspects; all contributing to the overall SUNSET research objectives.

Table 8-1: Key Living Lab Characteristics

	Enschede	Leeds	Gothenburg
Key Information			
Living Lab Type	Main Living Lab	Reference Living Lab	Reference Living Lab
Living Lab Co-ordinator	Municipality of Enschede	University of Leeds	Viktoria Swedish ICT (Research institute)
Governmental involvement	City of Enschede is a project partner	West Yorkshire PTE offered some assistance.	Gothenburg Region was involved in the Living Lab Preparations
Recruitment area	Enschede and surroundings	City of Leeds	Gothenburg Region
Target groups	Open sample City centre commuters	General public sample Time poor travellers	Commuters to Lindholmen Science Park and city centre
Statistics			
Living Lab Participants	268	112	138
tripzoom users (#)	108	6	95
Trips (#)	28.104	2.157	19.746
Kilometres driven (km)	355.874	19.673	337.698
Recruitment			
Proxy companies and networks	Twente Mobiel, four associated companies	West Yorkshire Travel Plan Network	Business Region Göteborg, Lindholmen Science Park, August Leffler & Son, Saybolt Sweden AB
Newspaper ads	☑	☑	☑
Facebook ads	☑	☑	☑
General online ads	☑	☑	☑
Flyers & Posters	☑	☑	☑
Digital newspapers	☑	☑	☑
University Lectures	☒	☑	☑
User interaction during Living Lab Stages			
Living Lab Preparation	Questionnaires, focus group	Questionnaires, focus group	Questionnaires
Living Lab Pre-operation	Release evaluation, technical trial	Release evaluation, technical trial	Release evaluation, technical trial
Living Lab Operation	Four experiments	Focus groups	Three experiments

Living Lab planning
As the Living Lab experiments were developed using an iterative approach, there has been uncertainty and shifting in the planning. Contingency plans and a flexible planning were used to address the risks associated with these uncertainties. These plans proved to be of great value as they enabled the Living Lab Co-ordinators to actively use the experiences of the other labs in the operation of their own.

8.2 Process

A number of different management processes were observed to be of significance to the successful implementation of a Living Lab. Based on the experiences in the different SUNSET project Living Labs we think that a process and resource analysis that offers insight into: user recruitment, system vulnerabilities, data management, Living Lab coo-ordination, and stakeholder involvement can be useful as lessons to future Living lab implementations.

Recruitment
The time and resources required to recruit the anticipated number of users has been a constant challenge for all three Living Labs. It was found difficult to introduce tripzoom in an appealing and easy-to-comprehend way to users due to the diverse app features and research objectives. In addition it was found that support from Living Lab co-ordinator was required to 'hand-hold' users over hitches at the registration phase, otherwise the rate of attrition increases. For future projects it is recommended that at least the purpose of the introduced app can be explained and summarized in one short, single sentence. This will allow better promotion of such apps, allowing recruitment of more targeted users.

Living Lab Co-ordinator
In all three Living Labs there was a central person who acted as the Living Lab Co-ordinator. This central role turned out to be a valuable position within the Lab. As this person had close contact with both the users and the developers, communication worked well. A broad range of user feedback could be channelled towards the developers, and in depth technical user remarks could quickly be discussed with the responsible developer. Increased numbers of users would require a more distributed model and new practices of coordination and communication. As users expect a helpdesk to be available constantly, a Living Lab Co-ordinator worked almost in a 24/7 style. Specifically in Enschede, the fact that the municipality took this role meant an even stronger position with all stakes at hand. This way municipal stakes were taken in consideration by default, but also caused users to have high expectations.

System vulnerability
A common finding across all three Living Labs was that users expect high quality software to test, even if it is an alpha or beta version. Although corrective actions took place, the users in all the Living Labs faced significant difficulties with registering and using tripzoom. Therefore it has been suggested in chapter 7 to aim for a stable system with limited research objectives in Living Lab trials.

Stakeholder involvement
Along the same lines, the inclusion of stakeholders has presented particular challenges in all Living Labs. Enschede had a distinct advantage since the local authority was part of the SUNSET consortium. Yet, the city council in Leeds has expressed interest about SUNSET, as had transport operators and some other large employers. In Gothenburg, the Business Region Göteborg and Lindholmen Science Park in particular became involved in the recruitment and involvement of stakeholders. However, informing, coordinating and managing the expectations of such

stakeholders proved to be a significant task which could not be successfully completed within this timeframe based on the available resources.

Data management
Organising and managing data was a major task for the Living Lab Co-ordinators as explained in detail in chapter 3. Local and national data protection variations coupled with the lack of experience by the approving authorities of similar Living Lab implementations influenced system design and in particular the insistence of consent form stage. It was found across all three Living Labs that it would have been useful to delegate this task as a specific activity which would be realised in coordination with the system design and Living Lab implementation. On-going discussion around the new General Data Protection Regulation might ease this process, as there will hopefully be more equal procedures between different countries.

8.3 Output

The three concrete outputs of the Living Lab operation are the management model, the experimental design and the privacy framework.

Management Model for Living Lab Operation
As highlighted throughout this deliverable, a management model for operating Living Labs has been successfully developed and tested in Enschede, Leeds and Gothenburg. Enschede and Gothenburg managed to expand testing to include more challenges, as was allowed by the local circumstances. However, all three Living Labs made a positive contribution since it is worth operating such Living Labs in urban areas with different local circumstances. In the Gothenburg Living Lab, the ITRACT project has shown great interest in the management model and how it may be used for operation the Living Labs.

Experimental Design
In all living labs, one of the main challenges in designing the experiments is the wide set of optimisation parameters. On the one hand, a meaningful and personal user experience is desired. On the other hand, there are system and project level goals to be achieved. For the design of experiments with the use of tripzoom, this worked very well. As it was specifically designed for these experiments, the alternative nature of the social media experiment in Enschede and the focus groups in Leeds fit less well within the format.

Privacy Framework
Privacy concerns were of equal importance amongst the different labs co-ordinators: it is generally perceived to be a major issue and the outcomes of the qualitative work in the Leeds Living Lab confirm this to be the case with the Leeds focus group participants. However users of tripzoom (in the mobility monitoring research) in the Living Labs did not raise the issue substantially and this may be because only those who were comfortable with the arrangements for privacy had proceeded to become users. In the Leeds Living Lab, conformity with the different privacy regulations created additional processes and a burden of work for both the Living Lab Co-ordinator as well as the user. The framework as it was setup within the SUNSET context has already been reused in the SMART project in Enschede.

8.4 Outcome

As well as concrete outputs there are two specific outcomes identified from the process of implementing the SUNSET Living Labs. These outcomes are the proof of the concept and the legacy. We did not reach the level of a proof-of-product with significant take-up resulting in city-level effects on congestion, sustainability, safety and well-being. Therefore the tripzoom

implementation showed too little operational success. Nevertheless the development and operation of tripzoom in the field as created a number of valuable learnings on the strengths and weaknesses of the concept, showed that the concept works on an individual level and finally creates a solid basis for next generation products and services.

Proof of concept
Overall, the proof of the SUNSET concept has taken place, with different Living Labs highlighting particular aspects and effects as reflected in the Living Lab evaluation (D7.5) All Labs had their distinct areas of focus, contributing to the total SUNSET concept.

Legacy
Within the SUNSET project, new technology and services have been developed and tested in situ. More detail on the uptake can be found in D8.2 on Exploitation results.

This legacy of tripzoom has resulted in service exploitation uptake by both LocatieNet and Mobidot, a spin-off company from Novay. Both have taken a position as ICT service provider of (social networking based) mobility services leveraging on three important components: automated 24x7 tracking functionality, personalised information delivery and incentive distribution. A number of next generation Apps/services based on the SUNSET and tripzoom ideas, the SUNSET technical innovation components and project learnings are developed and already exploited by these companies in (semi-)commercial settings in the Netherlands.

Secondly, several new projects have started to continue R&D on the concept of SUNSET and on tripzoom like ICT systems for transport. These projects include:

- Big Data Centre, University of Leeds;
- SMART project, Enschede Municipality;
- Technology Strategy Board Feasibility project, University of Leeds;
- Algorithms for mode detection, University of Twente;
- Travel Surveys using automated methods, University of Twente.

The SUNSET legacy also contributed to the plan of an existing EU funded project, iTRACT (http://www.itract-project.eu/). This project is especially interested in the organization and operation of Living Labs within SUNSET.

Finally, in their role as municipality and direct stakeholder in urban mobility, the city of Enschede has positioned itself as a customer of tripzoom-type of social transport services and as a proving ground of these kind of new services. In that respect the Enschede Living Lab will continue to exist after SUNSET project end and will function as a testbed for next generation systems and services in the area of personal and social networking based mobility services like SMART. As such the Enschede Living Lab is an exploitation result in itself.

9 Lessons Learnt

As a result of the Living Lab experiences in the three Living Labs, and the Leeds Lab in particular, several valuable lessons learnt and tips for future Living Labs are documented in this chapter. This chapter gives an overview of the different lessons in a more or less chronological order of running a Living Lab. This chapter covers common lessons for the three Living Labs, with Living Lab specific additions underlined For lessons in relation to the experimental design, please also refer to SUNSET Deliverable 7.5 Living Lab Evaluation.
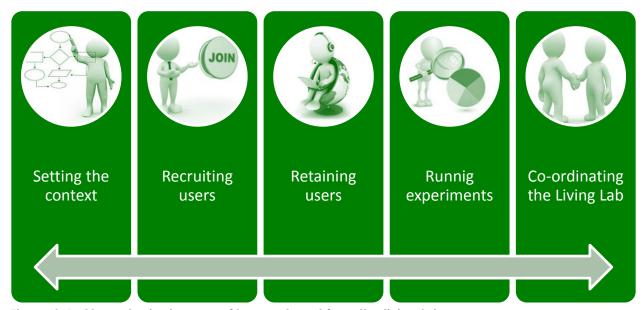
Figure 9-1: Chronological scope of lessons learnt from the living labs

9.1 Setting the context

Developing the application
Although development of the application was a research task, a solid user experience was nonetheless expected by the users. In the development plan, there should be specific attention for user consultation. Also, one should take in consideration the fact that the development in a live environment raises particular challenges compared with a static development context, for example bug fixing (and even feature development) are expected by users. However there are also advantages to this approach, for example in the case of SUNSET, the involvement of non-developers in the release based process resulted in valuable input to the development of the application.

Building the privacy framework
Although user interest in the actual privacy documentation may be limited, the development of privacy documentation is essential when working with location tracking of individuals. On the one hand, it helps the user to trust the integrity of the Living Lab Operation. On the other hand, it provides solid guidelines for choices to be made during the course of the project.

In the Leeds Living Lab, the privacy framework had to comply with statutory acts on Data Protection. Within a UK University context there is often a reluctance to engage with dataset

generation and storage management that result in data being held outside of the UK and are therefore not necessarily subject to UK statutory law.

Using the operational model
Using the operational model to structure the Living Lab work helps the Living Lab Co-ordinator to manage the different phases of the Living Lab. A structured, step wise process gives clear guidance to all stakeholders involved.

Organising a pre-operational stage
The pre-operational phase is a good way to work towards a larger release of the application. A number of lessons were learnt about this stage:

- As the application is exploring the boundaries of the technical possibilities, it is good practice to devote specific time to test the basic functionalities of the system.
- Extending the user base during the final stages of development helps to broaden the range of smart phone types that are used to test the app. This may serve to increase the number of future users of the app.
- In the case of using companies as proxies in recruitment, it is good practice to involve at least one 'friendly user' per company in order to make sure that features of specific types of smart phones that may be common in the company are taken into account.

9.2 Recruiting users

Triggering users
The first step for a user to get involved in the Living Lab is some sort of trigger to join. A careful choice of communication channels in providing the stimulus to join can help the Living Lab Co-ordinator keep control of the Living Lab size. Snowballing via social media might take place, but only when early users are satisfied with the product and can tell others 'what's in it for them'; preferably within one sentence. A viral effect could happen but cannot be planned. Due to a lot of competition in the general market place for apps, reaching out is difficult. Even if people do get involved in a Facebook page, conversion to the stage of app download is limited. Engaging users to participate requires systematic efforts from the consortium that is organizing the Living Lab. The consortium has to trigger an interest to participate and contribute to both the development of the service and the creation of new knowledge.

Contingency planning
A lesson learnt throughout the Living Lab recruitment phase was the necessity to have a very well–thought out contingency plan for recruitment. This was important to manage the relationship with 'gatekeepers' (organisations that through their functions have access to and are in active communication and have relationship of some trust with citizens) to recruitment and other key stakeholders. It was also important in ensuring consistency in responses to recruited users, particularly where recruitment had included the offer of a reward to participate. The contingency plan should cover the whole period of the Living Lab operation, in order to deal with and mange low volumes of recruits in all stages. Management of the relationship with recruitment 'gatekeepers' is vital to avoid the perception of ad hoc requests for help or persistent requests for help over time. This is often 'overlooked' if the key 'gatekeeper' stakeholders are also members of the consortium.

In the Leeds Reference Living Lab we identified the necessity to have a category of 'Gatekeepers'. These 'gatekeepers' are vital to the successful promotion and publicity of the work of the Living Lab.

Preparing contingency plans

In recruiting successfully it is important to establish contingency plans, that is, a series of strategies in case initial publicity to recruit users is only partially successful. This level of contingency planning is necessary to avoid the perception that any channels used are overloaded with requests, such as ad hoc requests to disseminate more recruitment material or to help recruit more users. We recommend a firm budget be associated with this task.

Rewarding participation

Surveys performed in SUNSET indicate that participants are not always triggered to participate by the prospect of tangible gifts; instead users may want to participate in the development of a service that improves everyday travel for themselves as well as the community as a whole. This does not mean that tangible gifts do not have a function in a Living Lab, to the contrary, tangible gifts have a role in both (a) stimulating curiosity and to reward users for participation; and (b) to stimulate behavioural change.

User enrolment

The majority of users dropping out of the experiment did so in the phase between signing up as interested in participating and actually participating. The process to download, register and install the app should be made as intuitive, seamless and efficient as possible. Barriers, unclear steps and choices should be removed in order to ensure that participants who have signed up do not drop out at an early stage. There is a distinction between a Living Lab that is conducted with a stable and pre-tested app and the case where the Living Lab forms a component of a research and innovation project. In SUNSET, the latter was the case. In this type of Living Lab there is a need to balance the requirement to ensure 'informed consent' with the requirement to ensure a 'seamless' download and registration process. Information about the project aims and the terms of participation should therefore be embedded in the enrolment process for users.

The lessons learnt in Leeds Reference Living Lab are: estimates of attrition should be incorporated into recruitment plans and allowed for at very early stages in the use cycle. Ranges for attrition in the recruitment contingency plans should be estimated in pilot studies and Living Labs should be aware of the possibility of high levels of attrition.

Downloading the application

To encourage as many users as possible to use the application, the smooth alignment of the regular app-procedures turned out to be essential. In early stages, there was an installer file available which many friendly users were unable to install without face-to-face contact. Once the app was available in the Google Play Store and Apple App Store, downloading and installing the application was no longer a hurdle.

Registering an account

Having experimental design control over the users in the Living Lab by manually assigning users to the Living Lab, turned out to come with a great cost. Users want to use an app as soon as they have downloaded it, so it is advisable to give at least some functionality without the time elapse involved in manual permission by the Living Lab Co-ordinator. Using available login services such as Facebook, Google, etc. makes it even easier for the user to join the Living Lab. However, easy access to an account must be addressed without compromising the users right to make an informed choice about whether to be a part of the Living Lab and consequently, part of a research project.

Using the application

Once people have installed the app, it is challenging to encourage them to maintain usage. Generally, people tend to forget about it unless there is some sort of reminder. This could be

done using the incentive schemes, successive experiments or 'out-of-app' communication (for instance a newsletter).

In order to keep the users interested in participation the application should also have a core message that is aligned with the core message used to trigger their participation (for example the expected environmental merits or the cost saving). Just because there has been success in recruiting a cohort of users, one cannot test everything (i.e. all possible experimental functions, the spectrum of incentives etc.) and expect all users to maintain their interest and to prolong their participation in the Living Lab.

Reaching out to the target group
When trying to motivate people based on sustainability aspects, it should be taken into account that there are two types of persons who may be very interested in participation, but who won't be able to contribute to the higher level goals: those who believe they are already acting in the 'right' way and those who may challenge the ability of the system to change them. It might be easier to recruit the desired target group based on characteristics from other data sources, for instance based on commute pattern data from the employer.

When trying to motivate people based on sustainability aspects, it should be taken into account that there is no easily available dataset of people's attitudes or desire and intention to change. This makes it hard for any Living Lab to recruit those people who have an intention to change. The lesson learnt was to use combined datasets of travel behaviour (for instance known commute patterns from the employer) and transport services provision (e.g., major employment sites parking capacity, public transport provision), to identify and recruit the desired target group.

The lesson learnt in the Leeds Reference Living Lab was to identify those employers who had most recently or were just about to change location particularly to the City centre where there is pressure on parking.

9.3 Retaining users

Running the helpdesk
A Living Lab always triggers feedback, as well as a need to be supported. One ground rule is that the application should be built to be as intuitive as possible to enable the users to self-support during the lab. However, in order to be able to operate successfully, the Living Lab feedback operation has to be organized in a systematic way. One fruitful way to do this in the SUNSET case was to setup and organize a helpdesk in a more or less 24/7 style. All comments and questions by users were directed to the helpdesk, where the Living Lab Co-ordinator fronted all users in a specific Living Lab. The helpdesk categorised the feedback and either directly addressed the issues or escalated it to a second line of support by the technical team. The effect for the lab was a systematic approach to both acknowledge user input and take care of the user's input in an effective way.

Aligning with developers
The Living Lab operational team had an important role to play in the interaction between the users and the developers. They acted as facilitators in translating the input from the users to the developers, resulting in alignment between the technical work packages and the on-going Living Lab experiments.

Involving users in the process
In addition to promoting users to feed back issues to the help desk, user involvement - and in the long run, retention of users in the lab - was stimulated by informing users about the progress in the project using regular newsletters to distribute information. When informing, the aim was not only to inform about progress based on user involvement but also to inform about the issues that were not managed (for example due to restrictions in resources). In this transparent way, feedback received from users was acknowledged, triggering more user involvement during the project.

9.4 Running experiments

Designing the experiments
A number of lessons were learnt in the implementation of the Living Labs. The first was there is a necessity for a pre-defined template for experimental design using incentives. Using the same pre-defined template in all Livings Labs made it possible to do cross-comparisons between the Living Labs.

The second was that the template should be organised with three sequential processes:
- On the first level the research question and aim of the research is stated.
- With this as a base, the context for the experiment was set e.g. what data to use and what target group to involve in the specific experiment.
- On the last level the actual experiment was designed in terms of what incentives to use, when to start the experiment, when to end it and how participation should be rewarded.

When the experiment in designed on this conceptual level, it can be implemented in the system and distributed to the users.

In the Leeds Reference Living Lab the lesson learnt was that it is necessary to keep a repository of 'experiments with incentives' using the template described above. This repository was required to ensure that consistency and change in communication style e.g., terminology and concept in interaction with users could be managed. This repository eventually would constitute an additional dataset.

Personalising incentives
Prior to the conceptual design of the experiment, the users were encouraged to use the system in their everyday life in order to measure regular behaviour. This created data which was used in the experimental design to create personalised incentives for the users. Based on the trip data, incentives were personalised to different users groups during experiment. The lessons learnt when working with personalisation were that:
- a lot of effort has to be spent on the personal design;
- a very flexible incentive engine is needed to also facilitate this on a technical level.

Taking time
A message shown by all the experiments in the Living Labs is the time users need to adjust and adapt to the challenge. One should not expect an overnight change, but grant users the time to familiarise themselves with the options they have. Therefore, it is advisable to design experiment in such a way that users are given the time to adapt.

Planning for the unexpected
A Living Lab is a living entity during set up, recruitment, retaining activities and the experiments. It is necessary to plan for the unexpected and have resources available in order to manage these unexpected issues. In SUNSET this resulted in the use of different and recurrent recruitment waves

to add participants to the labs (see previous discussion on contingency planning). The Living Lab Co-ordinator should work with a mind-set that everything can change over-night and might have to be redone, as well as the notion that reserve resources should be available to enable this mind-set.

9.5 Co-ordinating the Living Lab

The role of the co-ordinator
The Living Lab Co-ordinator is the central hub within the Living Lab. As there are many field of study involved in the operation of a Living Lab, this person should be able to bring all these fields together. A team of professionals in different areas (e.g. technical development, communications, experimental design) should be available to co-operate during the Living Lab.

Using management tools
The monitoring tools developed in the SUNSET project turned out to be of great value in operation of the Living Lab. Although one should be cautious about the users' privacy rights, insights from data can help to understand any issues a user experiences and improve the feedback given. Also, the location traces have a huge opportunity in providing management information to the road authority.

Storing the data
During the course of a Living Lab, a lot of valuable data is collected. For both the scientific community and the traffic managers, the location traces provide a useful source of information. However, from a user's perspective, personal data should be stored for as short a time as possible. The best way to cope with this tension is to have a procedure in place which can de-personalise the data. This may involve either stripping the locations of the journey start and end points or by storing data at an aggregate level.

Staffing the Living Lab Co-ordinator position
In typical staffing structures of road authorities, there is almost certainly no current position which should most logically staff the Living Lab Co-ordinator. Depending on the stakeholder fulfilling this role, there will be a difference in the approach taken. On one hand, the government might not be the most trusted party (by users) to handle personal data and to try to optimise the personal situation. On the other hand, the government is typically a place where different interests are joined and where there is funding available. In the SUNSET research context, it worked well to assign a local partner with the Living Lab Co-ordinator role, but in a more permanent situation this decision should be carefully considered.

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Appendix A.   Release Evaluation Spreadsheet

SUNSET				
T7.4 Evaluation				

Evaluation of Release				
~~lease version:~~	R4	Date of issue:		
Method:	Heuristic	Cognitive walkthrough	~~Usability test~~	
People:	Usability experts	Project members	~~End-users~~	
Setting:	Desktop	~~Lab~~	Field	

Notes to evaluators:
- Some cells come with a comment.
- Yellow fill means to be filled in by the evaluator.

Evaluator (when testing with end-users, use a separate sheet for each end-			
Name:		Partner:	
Platform			
Model:		Firmware:	

Cognitive walkthrough: task/step-level evaluation

Developer task	User actions	User experience	Priority level
Task # as in Roadmap	Translated into the corresponding user tasks	Does the user know what & how to do? [Yes; No & description of issue: as detailed as possible; be quantitative if you can]	What is the priority level of the issue? [Low; Normal; High; Urgent; Immediate]
e.g. #507	Download and install the app	No. Installation failed on Android 2.1 (model LG GT540GO); version not supported?	Urgent
	Pre-condition: install the latest release version (R4)		
#608	Task 1: Interact with the mobile app and the portal in your own language		
	Get your mobile phone and open Tripzoom		
	Check whether the user interface language is automatically adapted to your location (so, Swedish in Sweden, etc.).		
	Go to the portal (http://www.tripzoom.eu/tripzoom/index.php)		
	Check whether the user interface language is automatically adapted to your location.		
#477	Task 2: Get an overview of your trips		

Heuristic evaluation*: general-level evaluation

Related developer	Short description	Detailed description	Priority level
Task #('s) as in Roadmap; leave empty if not known/sure	Give a short name of the issue (& optional: the applied heuristics)	Provide detailed description of the issue. When possible, also suggest how it can be solved	What is the priority level of the issue? [Low; Normal; High; Urgent; Immediate]
e.g. #546, #548, #550	UI language too technical	The terms used are too technical for normal users. Replace e.g. "Identity relations" with "Personal settings".	Low
			High

Evaluation task guidelines and feedback spreadsheet used during the evaluation of the tripzoom early releases

Appendix B. SUNSET Information Leaflet

Information leaflet distributed to each participant prior to joining the tripzoom survey

Invitation paragraph

You are being invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the project?

The project aim is to develop a smart phone travel app. that can reduce congestion and improve safety and well being by encouraging people to change their travel behaviour.
The project is funded by the European Union.
The project runs from February 2011 to February 2014.

Why have I been chosen?

We are looking for people who are aged over 16, own a car or travel by car at times, own and use a smart phone. We have advertised in the West Yorkshire Travel Plan Network and relied on people app.roaching us if they are interested in taking part. We hope to recruit up to 200 people in Leeds.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without it affecting any benefits that you are entitled to in any way. You do not have to give a reason.

What do I have to do? / What will happ.en to me if I take part?

We are looking for people to download and use a smart phone travel app.. called 'tripzoom' which has been developed as part of the SUNSET research project. We are looking for people to use the smartphone app. for at least one month between September and December 2013.
Using the smartphone travel app. means that it will track your location and it will report back to you your travel patterns.

These travel patterns will be reported back to you using maps and summaries saying which locations you travelled from and to, how you travelled (e.g., by car or walking); what your purpose was in travelling e.g., going to work or home or for leisure; and some summary statistics such as how much the trip cost was, or how much CO_2 was emitted.

As well as travel patterns, the app. has two other main features: the ability to share information with members of your social networks and challenges and a system of point rewards. The smart phone travel app. will allow you to set up and decide on the members in your social networks

can see your information and what you share through the 'Settings' function of the travel app.. It is important that anyone considering taking part in the project is aware that they should look at the privacy settings in the 'setting' function and decide what information they want to share and who with. It is possible to set the app. up so that nothing is shared.

The third main feature of the travel app. is that it includes a set of challenges and rewards. The rewards are points that you can gain for attaining some of the challenges. The challenges are in the form of 'walk 500metres tomorrow and earn 50 points' and are issued by the team at the University of Leeds.

The travel app. will present to you a summary of the costs you have spent travelling, the CO_2 you've emitted, the points you've gained and whether you've spent more calories or been healthier in the week compared to two weeks ago. You also have the option of sharing these summaries of your travel with others: maybe you have a group of friends who want to help each other to achieve a goal – reduce costs in travel or get fitter and this feature is a way to share your progress.

This is a research project and we will also send messages in the form of questions to establish your assessment of the travel app. such as, "Please can you rate the ease of using the app. from 1 very easy, 2 easy, 3 neither easy nor difficult, 4 difficult, 5 very difficult". Because the questions will be sent through the app. they will be set up to be brief and require just one number answers.

In addition we may invite people to come to the University of Leeds to take part in focus groups or interviews where we ask you about your experiences of using the app. We will issue the invitations and attending will be entirely voluntary and there will be no negative consequences to declining to take part. Taking part may mean you find out more about the uses of the app. and would help us to assess which features work well.

Further information about how the app. works can be seen at the project website: www.sunset-project.eu. There you will find a video demonstrating the concept and at the site for 'tripzoom', http://www.tripzoom.eu/portal/gettripzoom.php there is a more detailed description of the features of the tripzoom travel app.

What are the possible disadvantages and risks of taking part?
We do not envisage sensitive issues being part of our research, so no such risks may occur.
Neither the websites or social media sites used nor the format of this research are designed to attract vulnerable groups. We do not intend to include participants who are under 16 years old or who are currently a prisoner on day release.

The sole risk which should be explicit to all tripzoom users is that other tripzoom users may be able to view one's trips which may have certain safety implications. Although the research team envisages this to have a positive effect, there is a risk of it being used to track an individual's location. Therefore, all tripzoom users are requested to review and adjust their privacy settings accordingly when they register with tripzoom.

Additionally, we cannot exclude the possibility of a sensitive issue arising in one of the future focus groups or an offending comment being posted on the tripzoom portal or facebook by an individual and being discussed by other users causing discomfort to an individual. If such a case arises, the common social media regulations are applicable (e.g. facebook) but there are also qualified experts within the research team who will take care of this using additional support from the University of Leeds if required.

Any potential risk related to data management issues has been considered and addressed. All data will be stored, archived and processed in the server of a SUNSET Consortium partner located in The Netherlands. All data are stored in an anonymised format, there is a high degree of confidentiality regarding data use and only authorised SUNSET partners have password protected access to the data collected through the tripzoom app..

Any privacy related risks are managed through the tripzoom app. and the available privacy options. There is a wide range of options regarding sharing e.g. locations, trips, rewards with everyone, friends, colleagues, family or no one. So everything is private unless a user decides to make his/her data visible to other members of the tripzoom social network. Users have also the option to allow or not (opt-in) tripzoom data to be visible through their facebook account (if linked with tripzoom).

The fact that users will become aware of their travel pattern may make users feel uncomfortable if they initially thought they had a healthier lifestyle or they were spending less money or time to travel. However, this is one of the research objectives (make participants review and reconsider their travel options) and may also generate some user benefits.

What are the possible benefits of taking part?
The main benefits of tripzoom are longer term improvements of the transport system in Leeds and potentially better informed decision making regarding personal travel. Therefore it is anticipated that for those people participating, the benefits will include reduced travel time or cost, a healthier lifestyle, reduced CO_2 emissions based on their journeys, as well as safer travel. Participants may have a positive experience in having the opportunity to have their views and needs included in this European research taking place in the city where they live/work. By considering some of the answer options participants may have an increased knowledge of technology and social network software as an indirect positive outcome. Participants may also benefit through the use of better incentives by the tripzoom app. issued by the research team in Leeds based on their own data and feedback trough tripzoom.

Will I be recorded, and how will the recorded media be used?
All participants of this research may be invited to participate in a focus group or an interview during the time they are using tripzoom in Leeds. Some of those interviews and/or focus groups may be audio and/or video recorded. If this is the case, an additional consent form will be signed prior to that recording. All participants will be informed in advance when an interview or focus group will be recorded and will have the option to object or to have their data deleted within one week of the completion of the interview or focus group. These recordings may be transcribed by professional service providers who abide to the University of Leeds and UK Data Protection Act. None of these recordings will be published or broadcasted. The information contained in these recordings will be anonymised and may be used in reports or academic publications during or after the completion of the SUNSET research project. The audio and/or video recordings of your activities made during this research will be used only for analysis and for illustration in conference presentations and lectures. No other use will be made of them without your written permission, and no one outside the SUNSET research project will be allowed access to the original recordings. The recordings will be kept safe in a password protected server at the University of Leeds and only authorised members of the SUNSET research team will have access to these recordings, which may be used solely for research purposes.

Will my taking part in this project be kept confidential? / What will happen to the results of the research project?

All tripzoom generated data is anonymised and transferred to a secure server in The Netherlands following the regulations of the European Union Data Protection Act which offers a similar level of data protection as the UK Data Protection Act. There is a high degree of confidentiality and only members of the SUNSET research team have access to tripzoom generated data. This access is granted following the use of at least two passwords by all SUNSET research team members. Therefore by agreeing to participate in this research and use tripzoom, all participants agree that the SUNSET research team may access their anonymised data for research purposes.

All the information collected about all tripzoom users during the course of this research will be kept
strictly confidential. Users will not be able to be identified in any reports or publications based on tripzoom generated data. No individual data will be linked with your personal identity (e.g.name), although the research team may use aggregate data using information such as gender, age groups or travel mode used. Any useful participant comments made by focus group participants may also be used in a SUNSET publication or report. However, it should still not be possible to identify any individual user and the SUNSET research team will use standard academic practice to ensure this. In case any user objects the use of their anonymised data, they are welcome to contact the research team in Leeds (e.g. by e-mail at sunset@its.leeds.ac.uk) and their anonymised data will be removed from the respective report or publication.

A SUNSET report about the use of tripzoom in Leeds will be uploaded on the SUNSET website (sunset-project.eu) in 2014 and publications in academic journals or conferences are anticipated to utilise anonymised tripzoom generated data. All users are welcome to view the SUNSET report at the SUNSET website and also request a copy for personal use of any deriving SUNSET publications. The research team will ensure that no individual tripzoom user may be identified in any of these reports or publications.

The results of this research project will be kept in anonymised format for up to ten years according to current UK and EU regulations. Therefore, by registering and using tripzoom all participants agree that their anonymised data may be used in additional or subsequent research following the completion of the SUNSET research project, always according to the UK and EU regulations. Further information about the University of Leeds data management procedures may be found here: http://researchsupport.leeds.ac.uk/index.php/academic_staff/good_practice/university_ethics _policies/data_protection_and_research-1.

Any privacy related risks are managed through the tripzoom app. and the available privacy options. There is a wide range of options regarding sharing e.g. locations, trips, rewards with everyone, friends, colleagues, family or no one. So everything is private unless a user decides to make his/her data visible to other members of the tripzoom social network. Users have also the option to allow or not (opt-in) tripzoom data to be visible through their facebook account (if linked with tripzoom).

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?
Basic socio-economic information of participants is asked during registration with the smartphone app. (i.e. tripzoom) through the webpage portal (http://portal.tripzoom.eu) or through their smartphone. Only the minimum required information is asked from participants and this includes their: name, gender, birthday, hometown, household dependencies, car ownership, bicycle ownership and public transport availability. This information is optional and requires minimal effort, but it is essential for evaluation purposes.

While using tripzoom participants offer their travel data which is transferred automatically to the secure server. This data includes travel time and duration, travel mode used, departure and arrival locations, trip objective, point rewards based on tripzoom challenges and social interaction through the tripzoom social networking portal.

It is anticipated that by conducting this research in Leeds will allow users to improve their daily travel in Leeds while also offering valuable information to researchers and local authorities about reducing congestion and emissions, whilst increasing safety and wellbeing.

Similar research is being undertaken within the same research project (by other SUNSET partners in Sweden and The Netherlands) and the research team anticipates that this approach will demonstrate historic and culturally specific processes, perceptions and practices.

Who is organising / funding the research?
This research forms part of the SUNSET FP-7 research project funded by the European Commission and is administered in Leeds by the University of Leeds. The other partners of the SUNSET research team are based in the UK, The Netherlands, Sweden and Germany.

Contact for further information
We hope that this information is clear and has answered your queries about this research. However, if you still need further clarifications, you are welcome to contact the research team in Leeds which is based at the Institute for Transport Studies at the University of Leeds. Our e-mail address is sunset@its.leeds.ac.uk and our postal address is:

Institute for Transport Studies
University of Leeds
34 University road
Leeds
LS2 9JT

All participants should retain a copy of this information sheet and return a signed copy of the consent form to the research team in Leeds. The consent form should be returned as an attachment by e-mail to sunset@its.leeds.ac.uk

Thank you very much for taking the time to read this information.

UNIVERSITY OF LEEDS

Appendix C.   Participant Consent Form

Institute for Transport Studies

Consent to take part in the SUNSET research project	Add your initials next to the statements you agree with
I confirm that I have read and understand the information leaflet dated August 2013 explaining the above research project and I have had the opportunity to ask questions about the project.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequence and that I can request that all my data be deleted within two weeks of withdrawing. In addition, should I not wish to answer any particular question or questions, I am free to decline. Contact: the Leeds SUNSET team at sunset@its.leeds.ac.uk or visit (http://www.tripzoom.eu/portal/) to withdraw.	
I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.	
I agree for the data collected from me to be used in relevant future research.	
I agree to take part in the above research project and will inform the lead researcher should my contact details change.	

Name of participant	
Participant's signature	
Date	
SUNSET Leeds team	
Signature	
Date*	

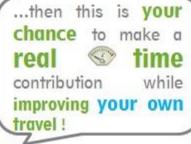*To be signed and dated in the presence of the participant.

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Project title [SUNSET]	*Document type*	*Version 1.3*	*Date*
	Consent form for SUNSET		October 2013

Appendix D.   tripzoom flyer