D1.3

Innovation Management Plan

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Project acronym: **IN2CCAM**

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ABBREVIATIONS AND ACRONYMS

Abbreviation	Meaning
AV	Automated Vehicle
CAV	Connected Automated Vehicle
CCAM	Cooperative Connected Automated Mobility
CCAV	Centre for Connected and Autonomous Vehicle
C-ITS	Cooperative Intelligent Transport Systems
GLOSA	Green Light Optimal Speed Advice
KPI	Key Performance Indicator
IMP	Innovation Management Plan
ICT	Information and Communication Technology
IPR	Intellectual Property Rights
IoT	Internet of Things
IT	Innovation Tool
Mx	x-th Month of the project (November 2022 is M1)
LL	Living Lab
PT	Public Transport
ROC	Remote Operation Centre
TM	Traffic Management
VRU	Vulnerable Road User
U-CI	User-Centric Innovation
UC	Use Case

1 EXECUTIVE SUMMARY

The Innovation Management Plan is the document reporting how the Innovations developed in IN2CCAM will be managed in order to effectively feed the Exploitation activities.

The Innovation Management Plan is the deliverable D1.3 of the Task 1.2: “Technical coordination and innovation management” of WP1: “Project Management and Quality Assurance”. It is expected to be delivered at the end of month 6 (April 2023).

The document contains 7 Sections, including this Summary, the Conclusions, the Reference list, and 5 Annexes.

More specifically, in Section 2.1: “IN2CCAM concept and approach”, the general aims of IN2CCAM are recalled: update physical and digital infrastructure and propose suitable operational infrastructure. Also, the approach to be used to attain such aims is outlined in terms of focus on the users within an open innovation ecosystem.

In Section 2.2: “Purpose of the deliverable”, the scope of the document is explained and its prospective result, i.e., the Catalog of Innovations, is anticipated. In Section 2.3: “Intended audience”, the intended recipients of the document are specified: IN2CCAM partners for awareness of Innovation procedure and actions, but also external parties interested to know how Innovation is managed in IN2CCAM.

Section 3: “Terminology and different approaches to Innovation” presents a critical analysis of the Innovation approaches existing in the literature as a prerequisite to introduce, motivate and explain the IN2CCAM way of considering Innovation and of defining Innovation Management. In particular, some terminological considerations are introduced in Section 3.1: “Terminological analysis of the term “Innovation””, highlighting the ambiguity of this term. Further on, in Section 3.2: “Different definitions of Innovation”, the pragmatic attitude of IN2CCAM about the definition of Innovation is introduced, on the basis of a quite large number of definitions proposed in the literature and presented in the Annex 1.

Section 3.3: “Different approaches to Innovation” discusses some approaches to Innovation found in the scientific literature which are relevant for the definition of the IN2CCAM approach. These are: Open Innovation (Section 3.3.1), Networked Innovation (Section 3.3.2) and User-Centric Innovation (Section 3.3.3). It is shown how they can be seen as evolving one from the other and their characteristics are analyzed.

Based on the considerations of Section 3, Section 4 presents the IN2CCAM approach to Innovation: the “IN2CCAM User-Centric Innovation” (Section 4.1) as a further evolution and specification of the User-Centric Innovation of Section 3.3.3. On this ground, the fundamental concept of “Innovation Tools (ITs)” is presented in Section 4.2.

In Section 5: “Innovation Management Strategy”, the IN2CCAM Innovation Management Plan is presented within the framework of the basic approach and concepts introduced in the previous Section. First, the IN2CCAM Innovation Management Procedure is introduced as

consisting of three Actions: A1, A2 and A3 (Section 5.1), to be performed cyclically in sequence.

Then the “Starting Point of the Procedure” (Section 5.1.1) is described as based on the Objectives and Tools indicated for the Use Cases of the six Living Labs as described in the IN2CCAM Grant Agreement. They are also reported in Annex 2.

“Action 1”, “Action 2” and “Action 3” are described, respectively, in Sections 5.1.2, 5.1.3 and 5.1.4. They lead to the construction of the Catalog of the Innovation Tools of IN2CCAM. Examples of the results of each of the three actions are shown in Annexes 3, 4 and 5.

The “Iterative nature of the Innovation Management Procedure of IN2CCAM” is stressed in Section 5.2. Finally, in Section 5.3: “Practical implementation of the Iterative Procedure”, the space (relative to the Living Labs) and time (relative to the iterations) of the procedure are analyzed and a compromise between a synchronous approach and an asynchronous one is proposed.

2 INTRODUCTION

2.1 IN2CCAM concept and approach

The IN2CCAM project (*in extenso*: Enhancing Integration and Interoperability of CCAM eco-system) is an Innovation Action referring to the Horizon Europe call HORIZON-CL5-2022-D6-01-04: Integrate CCAM services in fleet and traffic management systems (CCAM Partnership).

IN2CCAM aims to address the three following main challenges: update new physical infrastructures, use and update novel digital infrastructures, and propose suitable operational infrastructures. In order to reach such general objectives, the overall methodology of IN2CCAM is based on the definition, organization, implementation and evaluation of a set of Living Labs (LLs) that will be the basis for implementing a full integration of CCAM services in the transport system.

According to the LL methodology and approach, IN2CCAM activities focus on the **user** and the **Open Innovation** ecosystem, operating in 6 territorial contexts and integrating innovation processes in a partnership between public and private entities. The concept is based on a systematic co-creation approach and integrated innovation processes. These processes will be integrated through the co-creation, exploration, experimentation and evaluation of innovative services, scenarios, concepts and related technological solutions in real use cases of CCAM.

2.2 Purpose of the deliverable

The Innovation Management Plan (IMP - Deliverable D1.3) is the prospective IN2CCAM document indicating how the innovations developed by the project will be managed in order to constitute a valuable cornerstone for the Exploitation of the IN2CCAM results.

More in detail, the IMP explains how to build a **catalog** into which each IN2CCAM **innovation** will be inserted, with the specification of the conditions necessary to adapt it to situations different from the ones of the LLs for which it has been formulated.

To be clearer, IMP is only a **prospective document** (D1.3 is due on Month 6), so it defines and describes the mentioned **catalog** and presents an initial version of it. The catalog will then be updated, modified and completed whenever appropriate throughout the project life within task T1.2 (M1—M36).

2.3 Intended audience

This deliverable is intended to serve as an internal guideline for the appropriate innovation management of the IN2CCAM project. The main goal is for all beneficiaries to understand the IN2CCAM approach to innovation and the procedures dealing with innovation management. It may also be an informative report for those external parties interested in different aspects concerning IN2CCAM innovation potential and its development.

3 TERMINOLOGY AND DIFFERENT APPROACHES TO INNOVATION

In this Section, the IN2CCAM **approach** to **Innovation Management** is presented, starting from a discussion of some basic concepts and definitions. This constitutes the background for the formulation of the IN2CCAM **Innovation Management Plan** that will be presented in Section 4.

First, it is important to point out that the models following the Innovation Management approach **do not focus on the development (or production, or generation) of Innovation itself**, but rather on the evolution of innovation management strategies under different social, economic and political circumstances.

Among the infinite Innovation Management strategies, the approach of IN2CCAM is to **monitor, extract, describe, formalize, systematize** the tools **formulated** and **developed** in **WP3, as they were used** and **demonstrated** in the six Living Labs in **WP4**, and **evaluated** in **WP5**, in order to feed the **Exploitation** function of the project of **WP6** and **WP7**.

3.1 Terminological analysis of the term “Innovation”

But what is **Innovation**?

First of all, it must be pointed out that, from a purely **terminological point of view**, Innovation is an **ambiguous** term. It often denotes the **activity** or the **process** of innovating, i.e., producing “something” new, but sometimes it also denotes the **result** of such process, i.e., an improved product or process (or combination thereof). Furthermore, it could also indicate the **tool(s)**, or **mean(s)** used to perform such process, As such, this ambiguity would sometimes lead to bizarre shortcoming statements, like “*innovation is the process of producing innovation*, or *an innovation”*.

With the above specifications, Innovation Process is an action that produces Innovation (or, better, Innovative) results using specific Innovation Tools.

Throughout this Section, the peculiar specification of Innovation Tools in the framework of IN2CCAM will be clarified (cf. Section 4.2 below).

3.2 Different definitions of Innovation

In the scientific and technical literature, **several different definitions** of the term “Innovation” have been proposed. A selected choice of the proposed definitions is presented in Annex 1.

From a methodological point of view, **IN2CCAM does not intend to claim that any definition is more or less appropriate than any other one**. As a matter of fact, **IN2CCAM does not intend to adopt, nor to propose, a specific definition**. We assume the point of view that **each definition has its own motivation and validity for the conditions, situations and approaches for which it has been proposed**.

Clearly, a complete and detailed analysis of the different definitions of Innovation is far from the scope of the present document. The examples in Annex 1 have been introduced only for the sake of motivating the need to specify which is the point of view under which IN2CCAM, and the present document, consider Innovation.

3.3 Different approaches to Innovation

Innovation management is a challenge due to the change of the elements that are part of the innovation. The elements (objectives, actors, and their roles) may change depending on network's development phases in respect to technology life cycle and innovation development process (Brass, Galaskiewicz, Greve, & Tsai, 2004).

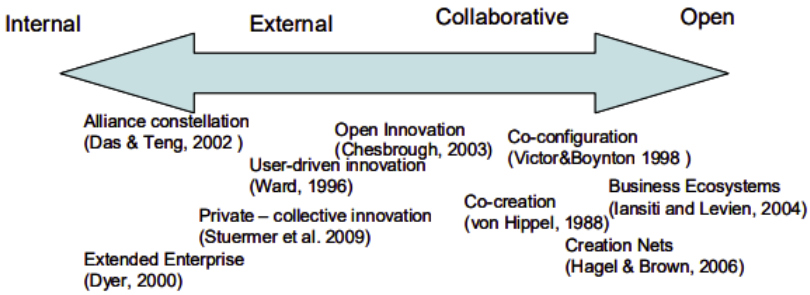

Figure 1. The continuum of networked innovation (Valkokari, Paasi, Luoma, & Lee, 2009)

As Figure 1 presents, there are several partly overlapping concepts for innovation systems and models based on different approaches (Valkokari, Paasi, Luoma, & Lee, 2009).

Figure 1 shows two extremes in terms of innovation. Starting from the left, internal innovation describes clearly defined and **Closed Innovation** systems or innovation networks. If we focus on the opposite extreme, the figure shows the **Open Innovation**, where partners can change dynamically or can be unknown (Valkokari, Paasi, Luoma, & Lee, 2009). Several authors have defined different concepts of innovation that can be located along this continuous line. According to the approach, the concepts described in the different investigations emphasize cooperation even with competitors in the market (Das & Teng, 2002); relationships with customers (Von Hippel E. A., 1988), (Victor & Boynton, 1998), and suppliers (Dyer, 2000). It has been also described the private-collective innovation (Stuermer, Spaeth, & Von Krogh, 2009), focused on relationships between individuals and firms, and user-driven innovation (Ward, 1996), aiming to systematically adopt the user's needs.

3.3.1 Open Innovation

An important specification of the concept of Innovation which is useful for IN2CCAM is the one of **Open Innovation**. This method supports the idea that innovation occurs because of interactions between different actors, rather than being the result of an isolated genius (Von Hippel E. A., 1988).

Open Innovation is defined by Chesbrough (Chesbrough, 2003) as the process in which "valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. This approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths." In Open Innovation, not only the internal environment of the organization is involved, but also the external environment.

The main advantages of Open Innovation are the great speed of innovation thanks to the use of existing resources; the reduction of research and development costs, by resorting to solutions or technologies already developed; the identification of new business opportunities thanks to a more open vision; the risk reduction in innovation processes and projects; and the relatively short time integration of new technological trends to improve the ecosystem and business processes (Chesbrough, 2003).

Chesbrough uses the Open Innovation funnel as a central concept to develop several key insights about Open Innovation. The funnel is an interesting concept, not only summarizing and visualizing key lessons of Open Innovation, but it has also the potential to connect Open Innovation to existing management and theories (Vanhaverbeke & Cloodt, 2014). The funnel represented in Figure 2**Errore. L'origine riferimento non è stata trovata.** shows what the Open Innovation process is like, starting with a large group of ideas and gradually reducing them until reaching the best and most appropriate idea.

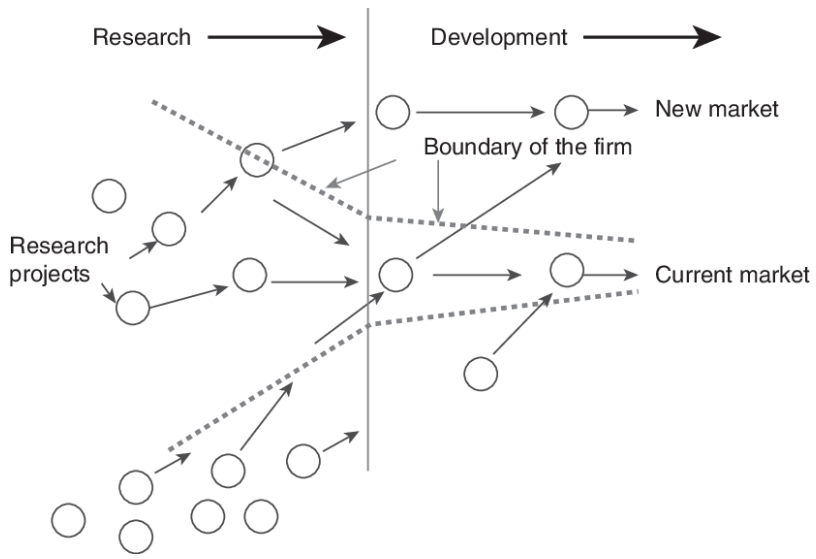

Figure 2. Open innovation funnel (Chesbrough 2003)

3.3.2 Networked Innovation

Open Innovation begins, as explained, inside a company that collaborates with external agents to obtain a result and be able to bring an innovative product to the market. However, in the case of the IN2CCAM project, it is a collaboration between partners within the quadruple helix framework and, therefore, we are talking about **Networked Innovation**. The Quadruple Helix is an innovation and collaboration model with a citizen/end-user perspective.

To reach the innovation approach used in IN2CCAM project, defined in Section 4, let's see how different innovation approaches develop from Open Innovation to User-Centric Innovation, going through Networked Innovation.

Networked Innovation "denotes a distinctive category, or type, of innovation processes. Occurs through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanism of control" (Swan & Scarbrough, 2005).

The starting point of Networked Innovation is not with the **traditional inside-out** approach but with an **outside-in** approach. This approach is based on broadening the vision of a company in such a way as to making it possible to identify new business opportunities (Maurer & Valkenburg, 2014).

The study carried out by Rehm et al. defines **three basic questions** that need to be answered to implement a comprehensive information management in Networked Innovation (Rehm, Goel, & Junglas, 2016). The three basic questions and the relations between them are pictorially represented in Figure 3.

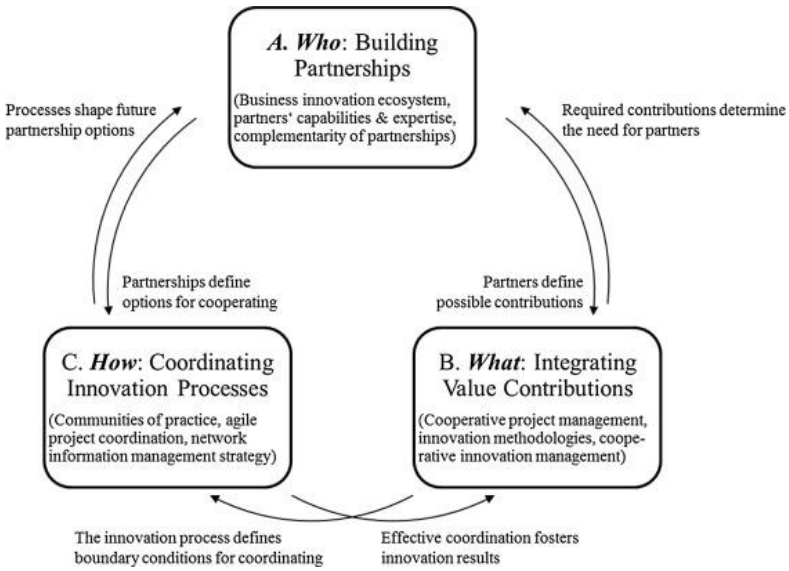

Figure 3. Analysis scheme defining the three challenges of "who, what and how" in networked innovation (Rehm, Goel, & Junglas, 2016)

3.3.3 User-Centric Innovation

Going beyond the Networked Innovation, if we consider a fourth basic question: “why”, we find that **user needs** can be the starting point of innovation. Users are firms or individual consumers that **are expected to benefit from *using* a product or a service** (Von Hippel E. , 2005). In this way, we arrive to the concept of **User-Centric Innovation** as another innovation approach.

User-Centric or Customer-Centric Innovation focuses on addressing the customer needs and applying innovation in the process (Steinhoff & Breuer, 2009). This kind of innovation can be beneficial for firms’ growth due to the importance given to the user or customer needs (Matriano & Rahman Khan, 2019). In fact, (Lilien, Morrison, Searls, Sonnack, & Von Hippel, 2002) proved that the user-centric approach can be systematically used by organizations to improve the success of their new product development process. User-Centric Innovation proved to be a systematic approach to generating breakthrough innovations and was able to outperform comparable innovative approaches (Bilgram, Brem, & Voigt, 2008).

Several studies on User-Centric Innovation certificate that many of the most important processes and products of different issues have been developed by individual users or by user firms (Enos, 1962), (Freeman, et al., 1968), (Von Hippel E. A., 1988), (Pavitt, 1984) and (Shah, 2000).

Therefore, as it can be seen in Figure 4, the User-Centric Innovation approach is an evolution of Networked Innovation, which in turn is a transformation of the Open Innovation approach.

Figure 4. Transformation from Open Innovation to User-Centric Innovation

4 CONCEPTUAL FRAMEWORK FOR INNOVATION IN IN2CCAM

4.1 IN2CCAM User-Centric Innovation

While the innovation process was generally described as starting from market analysis, as it has been seen in Section above, in the case of IN2CCAM the starting point is the investigation of the user needs, perceptions and expectations. The innovation process starts from this analysis, and this leads to the concept of User-Centric Innovation (U-CI). Figure 5 shows the transformation from open innovation to U-CI, going through networked innovation first.

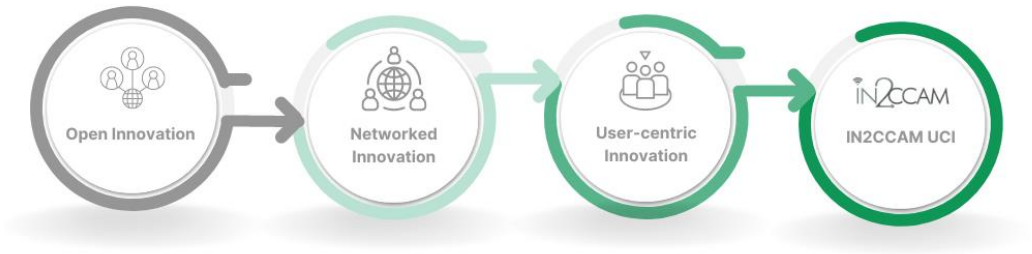

Figure 5. Scheme on how to reach User-Centric Innovation in IN2CCAM project

In IN2CCAM, U-CI is based on the collaboration of a group of partners who, through a set of tools that can be technological, infrastructural, organizational, administrative, legal, etc. seek to satisfy the needs, demands, expectations of the customers.

It is worth to analyze the features of IN2CCAM U-CI with reference to the concepts introduced in Section 3.3.

Summing up:

- the **Open Innovation** paradigm is a firm-centric one (in Figure 2 the boundaries of the firm are clearly indicated), but it considers these boundaries as “permeable” to “ideas”, that can cross the boundary in either sense (i.e., not only they can come from outside the firm – like in some previous approaches –, but they can also go out of it); being a firm-centric model, origins where ideas come from or destinations where they aim to are not considered
- the **Networked Innovation** paradigm moves a step forward, and proposes a structure for the world outside the firm, in form of a network, where ideas are exchanged between nodes, one of which is the firm; in this way, this model is no firm-centric anymore, since the firm is just one of the several nodes of the network
- the **IN2CCAM U-CI** paradigm differs from the two above ones in several respects, which are worth of consideration in order to better understand the characteristics and the peculiarities of this approach: first, now the users, or customers, are the center of the model; second, there is a multiplicity of “innovator entities”, not only one (the firm)

as in the previous ones; furthermore, such innovator entities are partners in a common innovation project which is publicly financed (or, more exactly, co-financed).

The peculiarities of the IN2CCAM U-CI bring some consequences worth to be considered: the paradigm contemplates (at least) two different types of actors: the **users**, or **customers**, and what we denoted as **innovators** (in this context, it is an extension of the concept of "firm" in Open and Network Innovation), i.e., the partners of the innovation project (of course, these categories do not need to be disjoint: often customers, or customer associations, can be partners as well – but the **different functions** should be considered from a functional point of view).

The distinction between **users** and **innovators** brings an important consequence: all actors of the paradigm exchange **information** (the "ideas" of the Open and Network models), but, unlike for the Open and Network models, it is now easy to specify the **nature** of this information: the information users communicate to innovators consists in their own **needs**. These users' needs constitute the starting point for the activity of innovators: their **objectives** consist in satisfying the needs of the customers. With these aims, the innovators formulate the (technical) requirements, which in turn are the starting point for the design, and then the implementation, deployment, testing, assessment, etc. of the appropriate measures, or tools, to meet user needs. For the moment, we call **Innovation Tools** (**ITs**) such measures or tools. A more complete and formal definition of Innovation Tool will be presented in the next Section 4.2.

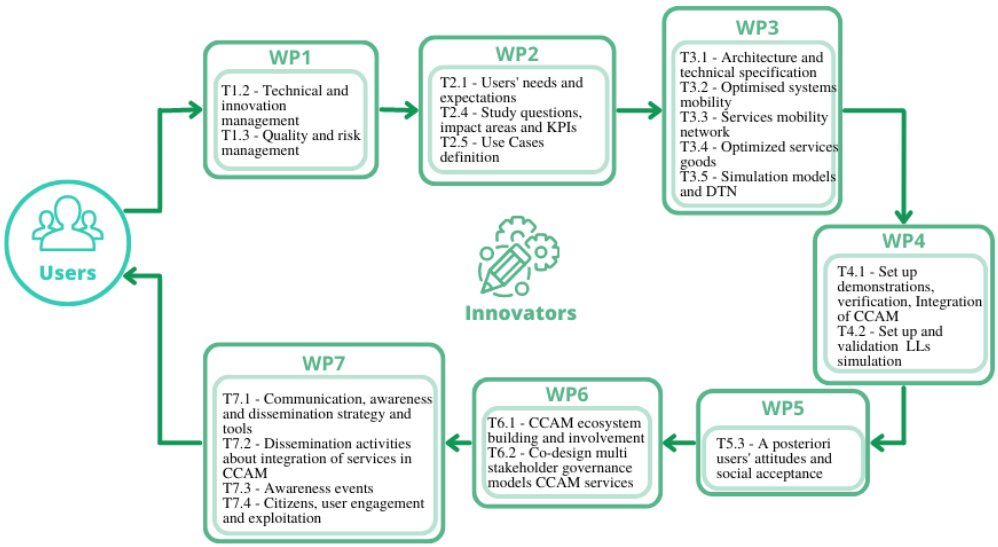

Figure 6. Information flow in IN2CCAM U-CI and the corresponding activities in the project workplan

Considering more in particular the flow of the needs from users to innovators in IN2CCAM U-CI, it is important to underline that it is implemented by a **mixed push-pull approach**, to which both users and innovators contribute. This fact has important consequences on the IN2CCAM Innovation Management and, as a consequence, on the IN2CCAM Project Management.

More in general, it must be pointed out that the information flow sketched above is **not** simply **linear** from the needs to the tools. In fact, it contemplates several **feedback loops** as necessary for guaranteeing that tools do actually meet the user's needs. This implies the participation of users in most of the phases of the development of the tools.

Finally, it must be mentioned that, for the sake of simplicity, we do not consider in the present document other types of information that actors exchange, such as commercial, financial, concerning Intellectual Property Rights (IPR), etc., which are not relevant to specify the IN2CCAM Innovation Management Plan.

4.2 Innovation Tools (ITs)

The concept of ITs, introduced above, is a fundamental one in the IN2CCAM strategy for Innovation Management, and deserves to be explained in detail. **ITs are the tools, or means, that IN2CCAM develops in order to meet the users' requirements**.

From an abstract point of view, ITs can be considered as **operators** in a space of "situations". They transform a **present** situation (**situation "as is"**) into a **different** one (**situation "to be"**) which **satisfies** the **needs** of the **users**, i.e. **achieves** the **objectives** of the innovators.

According to the IN2CCAM approach, **ITs** can be of **various nature**, not only technical or quantitative, such as or infrastructural or concerning Information and Communication Technology (ICT), but also qualitative, such as organizational, administrative, legal, normative, social, governmental, propositive, etc.

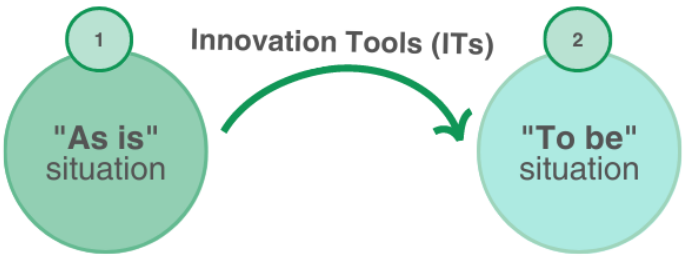

Figure 7. Innovation Tools as operators in a "situations" space

In order to provide a clearer description of the IN2CCAM ITs in coherence with the purpose the IN2CCAM Innovation Management Plan (which, as stated in the Introduction – Section 1.2 –, is devoted to providing suitable elements for the Exploitation of the IN2CCAM results), it is convenient to **strictly associate** each **IT** with the corresponding **need**(s), i.e., innovators' **objective**(s) it is intended to meet. Hence, we formally define an IT as the **pair** formed by a **tool** and the **objective** it is expected to attain: < tool | objective >. Consider that in this way we are identifying, in the present context, user needs and innovator objective, as anticipated above.

A consequence of the above definition is a **many-to-many** correspondence between **ITs** and **objectives**: the same IT may fulfill more than one objective, and, obviously, in order to

satisfy an objective, different tools may be necessary. In terms of the IT definition as a pair, **different ITs** may have the **same tool** but **different objectives**, or the **same objective** but **different tools**, or **both different tools and objectives**. This fact induces a **structure** on the set of formally defined ITs.

ITs are the **concrete output** of IN2CCAM in terms of Innovation. With these premises, as anticipated in the Introduction, the scope of the IMP is to explain how to build a **catalog of the ITs** developed in IN2CCAM. This is the subject of the next Section.

5 INNOVATION MANAGEMENT STRATEGY

In this Section, the IN2CCAM Innovation Management Plan is presented within the framework of the basic approach and concepts introduced in the previous Section. In this context, it should be kept in mind that, in IN2CCAM, Innovation Management deals with the way in which Innovation is managed, or handled, not produced or created, as pointed out above.

5.1 Innovation Management Procedure

The IN2CCAM Innovation Management Procedure consists of **three Actions**: Action A1, Action A2, and Action A3, to be **performed in sequence and cyclically iterated** during the course of the project, as shown in Figure 8. They will lead to formulate first, and then to complete, update, and specify the Catalog of the Innovation Tools of IN2CCAM.

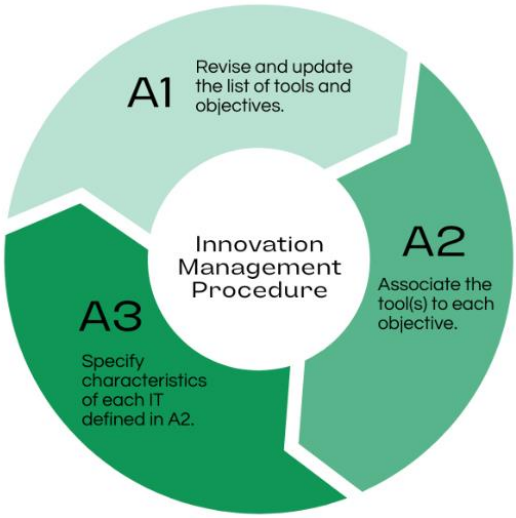

Figure 8. IN2CCAM Innovation Management Procedure

5.1.1 Starting Point of the Procedure

As a starting point for the procedure, we choose the **Objectives** and the **Tools** indicated in the IN2CCAM Grant Agreement for the Use Cases of the six Living Labs.

The rationale for this choice is twofold: first, in this way we use **already available information**, avoiding to bother the Living Lab stakeholders; second, we obtain a solid foothold about which an **initial consensus** is already available from the actors of IN2CCAM (in particular, the ones we consider **users** and **innovators**) within the framework of the ecosystems where IN2CCAM is deployed, tested and fine-tuned, at least in a specific environment.

The objectives and tools of the LLs from which we start are shown in Annex 2.

5.1.2 Action A1

The list of tools and objectives of Annex 2 need to be **revised** and **updated**, for at least two reasons.

At first, they have been formulated more than one year ago, when the IN2CCAM proposal was prepared. In the meantime, many reasons may have occurred for modifying them: evolution of the technology, availability of new solutions, emerging of new needs, etc.

Second, in the Grant Agreement only CT tools have been indicated, while we want to **include also non-ICT** ones, as stated in Section 3.2.

Therefore, Action A1 asks the LLs to:

- **verify and update**, whenever appropriate, the **objectives** and the **tools** of their Use Cases
- to include also **possible non-ICT tools** to be implemented in order to reach their objectives.

As mentioned above, Action A1 will be **cyclically iterated** during the course of the project.

An example of Action A1 is given in Annex 3.

5.1.3 Action A2

The scope of Action A2 is to **associate** to each **objective** of the Use Cases of the LLs, as identified in Action A1, the **tool**(**s**) that will be used to reach it.

In other words, we ask the LLs, for each objective: **how do you plan to reach that objective**? More specifically: **which tool**(**s**) do you intend to use in order to meet that **objective**?

In this way, the **ITs are created** as pairs of a tool and an objective, according to the formal definition given in Section **Errore. L'origine riferimento non è stata trovata.**.

It must be reminded that, as pointed out above, an **objective** may be associated with **more than one tool**, and, conversely, a **tool** may contribute to attaining **more than** one objective.

Note that in this description we think of Action A2 as a **future** one (cf. “will be used”, etc,), but **as the project progresses**, it will become a **present** one (“is being used”), and then a **past** one (“has been used”), since, as explained at the beginning of Section **Errore. L'origine riferimento non è stata trovata.**, all Actions will be **cyclically iterated** thorough the progression of the project.

An initial example of Action A2 is given in Annex 4.

5.1.4 Action A3

Action A3 is devoted to specifying the **features**, or **characteristics**, of each IT defined in the previous Action A2.

As a starting point, the following elements will be defined for each IT:

1. the **type** of the IT: technical, ICT, organizational, administrative, legal, normative, social, governmental, other (specify)
2. who/what developed/formulated the IT
3. estimated **costs** of the IT:
    a. **development**
    b. **operation** (e.g., per day, per month, or similar)
    c. **other** possible costs
4. who/what operates/applies/enforces the IT
5. sketch of the **problem/situation addressed** by the IT
6. sketch of the **conditions** to which the IT is **applied** in the LL (the "as is" situation)
7. who/what is **affected by** the IT (possibly including KPIs – their nature, not values)
8. how the IT **operates**
9. what is required for the **scalability** of the IT
10. what is required for **using/applying/replicating** the IT to a similar problem in a different city (**transferability**).

The above information will be updated, verified, modified during the span of the project according to the experience of the LLs following the Living Lab and the co-creation approaches.

An initial example of the output of Action A3 is shown in Annex 5.

5.2 Iterative nature of the Innovation Management Procedure of IN2CCAM

It is important to stress the **iterative nature** of the Innovation Management Procedure of IN2CCAM.

As it has already been repeatedly stated in this Section, the series of the above-described Actions A1, A2 and A3 will be **iteratively performed** throughout the development of the project.

The reason for this way of implementing the procedure is manyfold: in fact, during the progress of the Use Cases in the Living Labs, the **objectives** may **evolve** or **change** on the base of the accumulated experience, also due to the involvement of all the stakeholders (and, specifically, of the **users**, according to the User-Centric approach adopted in IN2CCAM).

This is coherent with the co-creation and the Living Lab methodologies.

But also, the **tools'** definition and formulation, and, consequently, implementation, may evolve in the light of the **practical evidence** collected during their deployment in the Living Labs.

We believe that keeping track of the evolution of the Innovation Tools, as a consequence of the just sketched processes, will provide **further insight** into how best to **exploit**, **scale** and **transfer** them.

5.3 Practical implementation of the Iterative Procedure

In practice, in order to decide **how to implement** the iterative procedure, two points of view must be considered: the **chronological** point of view (time) and the **local** point of view (space). The former refers to **when** to repeat iterations, while the latter refers to **where** to do it, i.e., in the different Living Labs.

These two aspects, together, pose the problem of **coordinating** the Procedure for the different Innovation Tools in the different Living Labs. Therefore, a coordinating entity is needed to ensure that high levels of innovation are kept as described in the Grant Agreement. We face this issue by attributing the role of coordinating the Innovation Management Procedure to the **Technical Management Team**, since it appears to be unnecessarily redundant and burdensome to create an ad hoc organism in the project.

Turning back to the time and space aspects, in principle, there are two alternative modes of behavior: the synchronous and the asynchronous ones. The first one contemplates iterating the Procedure at regular time intervals, simultaneously in all Living Labs. In the other mode, no common intervals are contemplated. Moreover, the synchronous modality refers to a centralized approach, and the asynchronous to a decentralized one. Apparently, each modality has some merits as well as some drawbacks.

In order to solve this dilemma, IN2CCAM adopts a flexible and dynamic approach: asynchronous operations with synchronous control (in the sense of supervision). This means that each Living Lab is left free to independently update the objectives, tools and Innovation Tools' description of its use cases, while the Technical Management Team will periodically (typically, each month) update the results of the three Actions for each Living Lab.

6 CONCLUSIONS

In the present document: Deliverable 1.3 – Innovation Management Plan it has been explained how the Innovations developed in IN2CCAM will be managed in order to effectively feed the Exploitation activities.

First, the general aims of IN2CCAM have been recalled: update physical and digital infrastructures and propose suitable operational infrastructures. Also, the approach to be used to attain such aims has been outlined in terms of focus on the users within an Open Innovation ecosystem.

A critical analysis of the Innovation approaches existing in the literature has been presented as a prerequisite to introduce, motivate, and explain the IN2CCAM way of considering Innovation and of defining Innovation Management. In particular, some terminological considerations have been introduced, pointing out the ambiguity of this term. Then, the pragmatic attitude of IN2CCAM about the definition of Innovation has been explained, on the basis of a quite large number of definitions proposed in the literature.

Some approaches to Innovation found in the scientific literature which are relevant for the definition of the IN2CCAM approach have been illustrated. They are: Open Innovation, Networked Innovation and User-Centric Innovation. It has been shown how they can be seen as evolving one from the other and their characteristics are analyzed.

On these premises, the IN2CCAM User-Centric Innovation has been presented as a further evolution and specification of the User-Centric Innovation and the concept of Innovation Tools has been proposed.

Then the IN2CCAM Innovation Management Plan has been introduced within the framework of the basic approach and concepts introduced before and the IN2CCAM Innovation Management Procedure has been defined as consisting of three Actions: A1, A2 and A3, to be performed cyclically in sequence. The initialization of the procedure and the three Actions have been described in detail. They lead to the construction of the Catalog of the Innovation Tools of IN2CCAM.

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ANNEX 1: DEFINITIONS OF INNOVATION IN THE LITERATURE

In the scientific and technical literature, **several different definitions** of the term "Innovation" have been proposed. As an example, consider the classification of Edison et al. 2013:

Table 1: Definitions of Innovation

Who	Definition
(Acs & Audretsch, 1988)	'Innovation is a process that begins with an invention, proceeds with the development of the inventions, and results in the introduction of a new product, process or service to the market-place.'
(Damanpour, 1992)	'Innovation is defined as the adoption of an idea or behavior whether a system, policy, program, device, process, product or service that is new to the adopting organization.'
(De Jong & Kemp, 2003)	'Innovation behavior can be defined as all individual actions directed at the generation, introduction and application of beneficial novelty at any organization level.'
(Fruhling & Siau, 2007)	'Innovation is an idea, practice or object that is perceived as new to an individual or another unit of adoption.'
(Geiger & Cashen, 2002)	'Innovation refers to the creation of new product within the firm.'
(Hage, 1999)	'Organizational innovation has been consistently defined as the adoption of an idea of behavior that is new to the organization. The innovation can either be a new product, a new service, a new technology, or a new administrative practice.'
(Palmberg, 2004)	'Innovation is defined as "a technologically new or significantly enhanced product

	compared to the firm's previous product" which has been commercialized on the market.'
(Dibrell, Davis, & Craig, 2008)	'Innovations vary in complexity and can range from minor changes to existing products, processes, or services to breakthrough products, and processes or services that introduce first-time features or exceptional performance.'
(Edison, Bin Ali, & Torkar, 2013)	"Innovation is production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome."
(Dziallas & Blind, 2019)	"The term innovation refers to both innovative ideas that are intended to be commercialized in the market and ideas that have already been successfully commercialized."
(Ioanid & Iliescu, 2022)	"The process of innovation makes the debut of a new plan or idea which will be later realized through a new function, so it keeps different than the process of a simple creation but becomes a dimension of business generation."

To be more specific, the following definition can be found in Eurostat's Concepts and Definitions Database:

Eurostat's Concepts and Definitions Database

Term
Innovation

Term extension
R & D - Oslo Manual

Definition
New or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process) (Source: Oslo Manual 2018). An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations (Source: Oslo Manual 2005).

Remark
This broad definition of an innovation encompasses a wide range of possible innovations. An innovation can be more narrowly categorised as the implementation of one or more types of innovations, for instance product and process innovations. This narrower definition of product and process innovations can be related to the definition of technological product and process innovation used in the second edition of the Oslo Manual. The minimum requirement for an innovation is that the product, process, marketing method or organisational method must be new (or significantly improved) to the firm. This includes products, processes and methods that firms are the first to develop and those that have been adopted from other firms or organisations. Four types of innovations are distinguished: product innovations, process innovations, marketing innovations and organisational innovations.

Source
Organization for Economic Cooperation and Development (OECD) and Statistical Office of the European Communities (Eurostat), "Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation", Fourth Edition, Paris, 2018

Hyperlink
http://ec.europa.eu/eurostat/ramon/statmanuals/files/Oslo_manual_2018_en.pdf

Other link(s)
Organization for Economic Cooperation and Development (OECD) and Statistical Office of the European Communities (Eurostat), "The measurement of scientific and technological activities: guidelines for collecting and interpreting innovation data: Oslo manual)", Third Edition, Paris, 2005, par. 146

ANNEX 2: INITIAL OBJECTIVES AND TOOLS FOR THE IN2CCAM INNOVATION MANAGEMENT PROCEDURE

LL TAMPERE

Objectives
Develop and introduce several improvements in the local last-mile mobility for people
Integrate CCAV fleet monitoring and remote operation in the ROC
Exchange traffic information with Tampere TMC
Identify potential business models for CCAV fleet operation in Hervanta, Tampere
Design and deploy of concepts of fleet and traffic management including CCAM eco-system
Innovation-based ROC Remote Safety Operator
Private CCAV fleet for last-mile passenger services will be brought at Mobility Hub under ROC control

ICT Tools to be implemented
Digital twin for modelling, simulating and optimizing services
Traffic information and analysis tool
3D high-definition map
CCAV real-time environment perception information for safe operation and provision of this information up to be used at ROC
Communication between ROC and CCAV fleet and remote operation will take place over LTE/5G mobile network
CCAV fleet simulator

LL TRIKALA

Objectives
Integration level of the CCAM into the PT system and with the entire traffic management system, user behavior and acceptance
Business models
Traffic efficiency and traffic safety

ICT Tools to be implemented
Demand automated public transport services
Integration and interoperability between the abovementioned integrated system in the PT
Fleet management platform (via the RCC) and the city's traffic management
Interaction of the CAVs and digital infrastructure with VRUs and other vehicle drivers
Automated shuttles "green wave" via the city's smart traffic lights signaling system
Scaling-up the impact of CCAM fleet on traffic

LL TURIN

Objectives
To complete an urban CCAM ecosystem for the city of Turin
To apply and demonstrate new traffic management strategies supported by the CCAM eco-system also with the aim of balancing traffic flow

To simulate and evaluate the impacts on the road network of traffic management strategies in different CAV adoption scenarios

ICT Tools to be implemented
CCAM vehicles can be used as additional sources to improve the information reliability and allow vehicles to optimize their navigation solutions.
Traffic Management strategies supported by the CCAM ecosystem: evaluate impact on road network in terms of improved congestion control, safety for the VRU and drivers and emission reduction
TM (Traffic Management) strategies will be accomplished through an optimization of the overall traffic scenario based on prediction and traffic simulation models.

LL VIGO

Objectives
Enabling and analyzing data and information interchanged among the CCAV fleets, Traffic Infrastructure
Define, deploy and test traffic management strategies on urban roads which enable a smooth, balanced, safer and more efficient performance of CCA driving in coexistence with other users.
Study safety and efficiency CCA driving impact
Data interchange among the three groups of actors (vehicles, infrastructure, pedestrians or cyclists) to build a virtual precise map

ICT Tools to be implemented
Traffic light priority and regulation for CCAM fleets according specific needs and requirements.
Reaction of CCAVs to the presence of Emergency Vehicle approaching anticipated by traffic infrastructure will be addressed

LL BARI

Objectives
Develop and simulate a route planner for people and goods involving CCAV
Develop and simulate innovative urban freight transport and logistics in the city center to reduce empty miles and traffic.
Provide usable digital tools for citizens

ICT Tools to be implemented
Simulation models for digital twin implementation based on traffic data and information
High quality of digital satellite maps for an up-to-date location in order to optimize the movement of people and goods based on Galileo and Copernicus services

LL QUADRILÁTERO

Objectives
Optimize urban space, loads and reduce empty miles through dynamic routing by simulating different deployment scenarios for CCAM vehicles

ICT Tools to be implemented
Real time traffic information
Off-street Parking occupancy information

Electrical Vehicle charging stations'
Touristic and social events data
Mobility and Civic Incidents and planned roadworks
Air quality and Weather observations
Foot and bicycle traffic information will be available in the near future, generated by IoT devices installed in key points of the city
Geospatial data of the region

ANNEX 3: AN EXAMPLE OF ACTION A1

LL VIGO

Objectives
Enabling and analyzing data and information interchanged among the CCAV fleets, Traffic Infrastructure
Define, deploy and test traffic management strategies on urban roads which enable a smooth, balanced, safer and more efficient performance of CCA driving in coexistence with other users.
Study safety and efficiency CCA driving impact
Data interchange among the three groups of actors (vehicles, infrastructure, pedestrians or cyclists) to build a virtual precise map

ICT Tools to be implemented
Traffic light priority and regulation for CCAM fleets according specific needs and requirements.
Reaction of CCAVs to the presence of Emergency Vehicle approaching anticipated by traffic infrastructure will be addressed

Objectives (update)
- To enable data interchange among the three groups of actors (vehicles, infrastructure, other users) to build a virtual precise map real time updated and accessible.
- To analyze the data and information interchanged among the CCAV fleets, Traffic Infrastructure
- Define, deploy and test traffic management strategies on urban roads which enable a smooth, balanced, safer and more efficient performance of CCA driving in coexistence with other mobility users.
- Study the potential impact of CCA driving in safety and efficiency.

Non ICT tools
- Specific traffic regulation and management strategies for CCAM (enabling CCAM lane, definition of traffic regulation strategies specific for CCAM)

ICT Tools to be implemented (updated)
- Data sharing platform (to be defined and deployed)
- Hybrid connectivity ITS-G5 cellular platform (to be adapted)
- 2 connected and automated vehicles (to be adapted)
- Extended C-ITS services: enhanced GLOSA and VRU detection (to be defined and deployed)
- Execution of specific strategies Traffic light regulation for CCAM fleets according specific needs and requirements. (to be defined and deployed)
- Data recording from connected users to feed driving models for simulation (common drivers and EV drivers) (to be defined and deployed)
- Simulation tools (analysis of reaction of CCAVs to the presence of Emergency Vehicle approaching anticipated by traffic infrastructure will be addressed)

ANNEX 4: AN EXAMPLE OF ACTION A2

LL BARI

OBJECTIVES	ICT TOOLS TO BE IMPLEMENTED
Collection and management of data and information on the city transport system	Use of artificial and intelligence tools
Provide usable digital tools for citizens	Realization of an intelligent, end-user centric model of mobility distribution (MaaS-Mobility as a Service)
Develop and simulate a route planner for people and goods involving CCAV	Develop of Bari logistic plan Update the municipal goods transport regulation Simulation models for digital twin implementation based on traffic data and information
Develop and simulate innovative urban freight transport and logistics in the city center to reduce empty miles and traffic.	Develop of Bari logistic plan Update the municipal goods transport regulation Simulation models for digital twin implementation based on traffic data and information
Improve urban traffic conditions	Sustainable mobility projects Improve mobility infrastructures Policies to encourage modal shift between public transportation and sharing mobility systems

ANNEX 5: AN INITIAL EXAMPLE OF THE OUTPUT OF ACTION A3

LL VIGO

Data sharing platform

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) **ICT tool**

2. who/what **developed/formulated** the IT? It is being formulated by Vigo (City Authority), ESYCSA (Traffic operator) and NeoGLS (technology developer and provider).

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): To be defined

4. who/what **operates/applies** the IT? ESYCSA

5. roughly sketch the **problem/situation** addressed by the IT: this platform enables an easy an accessible bidirectional information source for CAVs, extending the electronic horizon of their own sensors. For traffic operators, it provides an additional information about CAVs, the environment they are perceiving and their intentions (destination in the city, speed, position…)

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation). There is not "as is" situation. Nevertheless it is conceived as an extension of Vigo C-ITS Platform for IN2CCAM

7. who/what **is affected** by the IT (possibly including KPIs)? The current C-ITS Platform and CAV participating in IN2CCAM.

    - Draft KPIs:
        - Number of vehicles connected
        - Number of traffic management elements (traffic lights, VMP, parking…) available in the platform
        - Number of entities (vehicles, pedestrians, VRUs…) provided from AV to platform
        - Number of parameters shared from AV. (position, speed, destination…)
        - Number of new C-ITS services defined and deployed by the platform.

8. how the IT **operates**? Not defined yet, but the aim is to use standard ETSI messages as much as possible to ensure a good interoperability basis in the information exchange.

9. what is required for the **scalability** of the IT? To be addressed

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? To be detailed, but as a draft reply: the needed hosting and standardized communication protocols and data formats.

Hybrid connectivity ITS-G5 cellular platform

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify):ICT

2. who/what **developed/formulated** the IT? ESYCSA and NeoGLS with the City of Vigo.

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): difficult to quantify since is the sum of several developments and it is integrated in the exploitation and maintenance contract.

4. who/what **operates/applies** the IT? ESYCSA

5. roughly sketch the **problem/situation** addressed by the IT: This platform provides CAV all available C-ITS services Day 1 and Day 1,5 available in the city to human drivers in a ETSI standardized format.

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation) ITS-G5 RSUs deployed in the LL provide this services

7. who/what **is affected** by the IT (possibly including KPIs)?

   Draft KPI:

   number of C-ITS services currently available

   Number of vehicles connected to platform

8. how the IT **operates**? It is operated by ESYCSA and the City of Vigo with the support of NeoGLS.

9. what is required for the **scalability** of the IT? To be adressed

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? To be detailed, but as a draft reply: the needed hosting and standardized communication protocols and data formats with the legacy and existing equipment of the city. If not standard communications, developing the needed adaptations.

Two connected and automated vehicles

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : Technical

2. who/what **developed/formulated** the IT? Each of the vehicles are prototypes developed and equipped by Vicomtech and AKKA respectively

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): TBD

4. who/what **operates/applies** the IT? AKKA and Vicomtech

5. roughly sketch the **problem/situation** addressed by the IT: the vehicles will allow to develop and test the use cases in the corresponding scenarios as well as collecting the needed data.

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation): To be defined.

7. who/what **is affected** by the IT (possibly including KPIs)? TBD.

   Draft KPIs:

   - Number of trips performed in LL
   - Volume of data collected
   - Number of kms
   - Number of vehicles connected
   - Number of entities (vehicles, pedestrians, VRUs…) provided from AV to platform
   - Number of parameters shared from AV. (position, speed, destination…)
   - Reaction time anticipation
   - Number of stops
   - Number of hard acceleration and braking events
   - (…)

8. how the IT **operates**? A specific team will operate each of the vehicles in controlled conditions at the LL

9. what is required for the **scalability** of the IT? Not applicable. The prototypes will allow testing the use cases from a generic point of view. Results may be particularized later on to a determined CCAM fleet use (passengers, logistics, delivery…)

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? TBD

Extended C-ITS services: enhanced GLOSA and VRU

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : Technical

2. who/what **developed/formulated** the IT? ESYCSA

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): TBD

4. who/what **operates/applies** the IT?: ESYCSA, NeoGLS and Vigo

5. roughly sketch the **problem/situation** addressed by the IT: Artificial vision cameras will be installed and integrated to detect the vehicle queue length stopped at a traffic light an provide a better speed advice to CAV. Also detect VRUs such as pedestrians in the intersection and create a warning to CAVS

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation). To be deployed, no current deployment.

7. who/what **is affected** by the IT (possibly including KPIs)? TBD

   The performance of CAV is affected by a better anticipation to approaching events.

   Draft KPIS

   - Reaction time anticipation (approaching a queue in a traffic light)
   - Reduction of hard acceleration/braking events

8. how the IT **operates**? Cameras and systems will be operated from Traffic Management center by ESYCSA.

9. what is required for the **scalability** of the IT? Standard formats to provide de information from infrastructure to vehicle. Adaptation needed to translate video metadata from video analysis

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? Right interfaces among equipment and platforms for data transmission.

Execution of specific strategies Traffic light regulation for CCAM fleets according specific needs and requirements

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : Technical

2. who/what **developed/formulated** the IT? ESYCSA

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): TBD

4. who/what **operates/applies** the IT?: ESYCSA and Vigo

5. roughly sketch the **problem/situation** addressed by the IT: This tool executes or activates a specific regulation in one or several traffic light intersections to allow CCAM fleets a safer and more efficient performance with beneficial impact in both, fleet performance and mobility as whole. The application of this strategies will be tested in simplified scenarios in separated lanes.

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation). To be deployed, no current deployment.

7. who/what **is affected** by the IT (possibly including KPIs)? Traffic infrastructure and management, CCAM fleets, human drivers.

   Draft KPIs:
   Medium speed increasing in trip
   Reduction of time trip
   Reduction in time of road occupancy.
   Reduction in the number of stops (improvement in efficiency)
   Reduction in the number of hard braking/acceleration events
   Reduction in platooning splitting events.
   Emissions/fuel consumption reductions.
   (…)

8. how the IT **operates**? CCAM fleets are connected to C-ITS Platform sharing real time information from its position, intentions (destination), speed and perception. They are getting information from traffic infrastructure, as well. The Traffic management center applies specific strategies. For instance, a CAVs fleet is circulating in platoon, which is known by management system since that information is shared. The CCAM management systems applies adapted green light time which avoids breaking the platoon. Also can provide a regulation which allows improving the flow of the CCAM fleet.

9. what is required for the **scalability** of the IT? To be elaborated

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? Interoperable interfaces among the architecture elements. A centralized traffic system compatible with C-ITS services.

Data recording from connected users to feed driving models for simulation

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : Technical

2. who/what **developed/formulated** the IT? ESYCSA, NeoGLSA, AKKA, Vicomtech

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): TBD

4. who/what **operates/applies** the IT?: ESYCSA, NeoGLS, AKKA, Vicomtech

5. roughly sketch the **problem/situation** addressed by the IT: Connected vehicles to Vigo C-ITS platform allows to anonymously record driving profiles from drivers using Vigo Driving APP. In particular emergency vehicle fleets of Firefighters and Police provide emergency driver profiles can also be obtained by ITS-G5 ssystems. The data sets in terms of position and speed profile will be recorded and provided for simulations to automotive partners (AKKA and Vicomtech) so they can use them to feed

their autonomous driving intelligence and address how to react to the presence of aforementioned users in advance.

6. sketch the **conditions** in which the IT is applied in the LL (“as is” situation): No “as is” situation

7. who/what **is affected** by the IT (possibly including KPIs)?

   Simulations can be fed with data from real users.

   Draft KPIS:

   - Number of trips recorded
   - Number of emergency services recorded

8. how the IT **operates**? Logging tools to be defined and deployed. Use of ESTI standard sets of data (CAM messages or other)

9. what is required for the **scalability** of the IT? TBD

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? TBD

Simulation tools

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : Technical

2. who/what **developed/formulated** the IT? ESYCSA

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): AKKA, Vicomtech

4. who/what **operates/applies** the IT?: AKKA, Vicomtech

5. roughly sketch the **problem/situation** addressed by the IT: Simulation tools will adress the analysis of CCAM capabilities than can’t be included under the scope of physical living lab tests.

6. sketch the **conditions** in which the IT is applied in the LL (“as is” situation). No “as is” conditions

7. who/what **is affected** by the IT (possibly including KPIs)? TBD

8. how the IT **operates**? Specific conditions to Vigo to be defined

9. what is required for the **scalability** of the IT? To be addressed

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? To be addressed

Specific traffic regulation and management strategies for CCAM

1. define the **type** of the IT (technical, ICT, organizational, administrative, legal, normative, social, governmental, recommendations, other – specify) : organizational, administrative, legal,

2. who/what **developed/formulated** the IT? City of Vigo in collaboration with ESYCSA

3. roughly indicate the estimated **costs** of the IT: development / operation (e.g., per day, per month) / other costs (possibly, order of magnitude): TBD

4. who/what **operates/applies** the IT?: ESYCSA and Vigo

5. roughly sketch the **problem/situation** addressed by the IT: The objective is explore how CCAM can help in improving mobility in the city. Examples of potential regulation and management strategies for Vigo would be those on question 8.

6. sketch the **conditions** in which the IT is applied in the LL ("as is" situation): no "as is" situation.

7. who/what **is affected** by the IT (possibly including KPIs)? Traffic management, City authority and CCAM fleets

   Draft KPIs:
   - Number of reactions by AVs to data shared from platform.
   - Number of enabled CCAM lanes
   - Number of specific user groups (CCAM fleets addressed)
   - (…)

8. how the IT **operates**? The city would define and aprove the organizational, administrative, legal, normative, aspects that would enable:

- Enabling specific CCAM lane.
- Allow particular CCAM fleets to circulate on such lanes (TBD, but some examples: autonomous passenger buses, last mile delivery fleets, vehicles devoted to provide services to passengers with special needs…)
- Define specific regulations for the different user groups, for instance:
  - Avoid mixed traffic in complex intersections through adapted traffic light regulation.
  - Enable extended green time in particular time slots for delivery fleets
  - Traffic light priority for passengers fleets in different degrees
- The details should be defined and concreted to the different user groups. The exhaustive definition and application of strategies is out of the scope of IN2CCAM. The idea is to test and demonstrate feasibility and potential benefits of the core technical tools that may enable the application of this strategies in the future. This, in summary, is
  - Separated lane for CCAM tests
  - Authorization to vehicle projects to drive autonomously.
  - Actuation over traffic management system.

9. what is required for the **scalability** of the IT? To be elaborated

10. what is required for using/applying/replicating the IT to a similar problem in a different city (**transferability**)? TBD.