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Managing Innovation in European Research Projects

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ABSTRACT: *This paper presents a new innovation management approach in research projects. Based on the transformation from Open Innovation to User-Centric Innovation, going through Networked Innovation, the starting point of the proposed innovation process is the investigation of the users and stakeholders needs. In the presented approach, users and innovators exchange information to satisfy stakeholders needs. In order to meet these requirements, innovators develop Innovation Tools (Its) as a result of innovation activities. The concept of "Innovation Tools" is introduced as the mean to meet users' needs and objectives. As a result of the study, a new innovation management strategy is defined. The defined strategy can be applied in European founded research projects. The originality of the presented work is the introduction of the novel innovation management approach called "European Project User-Centric Innovation" (EP U-CI), that can be applied in European founded research projects. The value of the EP U-CI strategy is enlightened by the application to the Horizon Europe IN2CCAM project and consists in the centrality of the users needs and in the way stakeholders interact with the innovators.*

Key Words*: European founded projects, Innovation management, Innovation tools, research projects, User-centric innovation.*

1. Introduction

In the world of research and development, innovation lies at the heart of progress and transformation. European research projects have long been at the forefront of pioneering ideas, technologies, and solutions that drive societal growth and economic development. However, the dynamic nature of innovation necessitates constant exploration and adaptation of management approaches to ensure successful outcomes.

This paper delves into the concept of innovation management within European research projects, with a specific focus on the integration of novel methodologies. By leveraging a user-centric approach and embracing networked innovation paradigms, this paper presents a new innovation approach with innovative ways of collaboration, efficiency, and impact.

The study begins by exploring the concept of innovation, considering its various interpretations and implications in diverse contexts. The *State of Art* section examines the evolving definitions of innovation and analyzes the different innovation approaches.

The main contribution of this paper is the introduction of an innovation management approach that we call "European Project User-Centric Innovation" (EP U-CI). This approach centers around the needs and

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expectations of end-users, considering them a fundamental part of the innovation process. In this way, the project partners can ensure that their initiatives are customer-oriented, leading to more meaningful outcomes.

Furthermore, the study emphasizes the iterative and dynamic nature of the EP U-CI approach, recognizing the importance of continuous evaluation, modification, and optimization throughout the project's life-cycle. A case study based on the IN2CCAM European project is introduced, where the Technical Management Team plays a key role in coordinating and supervising the innovation management procedure, ensuring high levels of innovation are maintained across the various Living Labs involved in the research project.

In this paper, Section 2 presents the state of art defining different concepts of innovation and their evolution, Section 3 defines the new innovation management strategy for European founded research projects, in Section 4 the case study is presented and, finally, Section 5 concludes the work.

2. State of Art: Concepts of Innovation and Their Evolution

2.1. Different ideas of Innovation

From a purely terminological perspective, innovation is an ambiguous term. It often refers to the process of creating and implementing novel ideas, products, services, or methods that lead to significant improvements, advancements, or disruptions in a particular field or industry. It involves introducing new or improved solutions that address existing problems, needs, or opportunities in a way that is both original and valuable. However, at times, it also denotes the result of such process, meaning an improved product or process (or combination thereof).

Moreover, innovation can also indicate the tool(s) or means used to carry out such a process. This ambiguity occasionally leads to peculiar shortcomings, such as the statement, "innovation is the process of producing innovation, or an innovation."

Innovation is characterized by novelty (unique and original), creativity (new ideas and concepts), practical application (real-world applications), benefits, successful implementation and taking calculated risks.

In an attempt to define innovation more precisely, three dimensions of novelty have been investigated: what is new, how new it is, and new to whom. To that end, the study (Johannessen, Olsen, & Lumpkin, 2001) has developed a scale that addresses six areas of innovative activity: new products, new services, new methods of production, opening new markets, new sources of supply, and new ways of organizing.

Innovation can occur in various contexts, including technology, science, business, arts, healthcare, education, and more. It is a driving force behind the progress and evolution of societies, as it continuously shapes and transforms the way we live, work, and interact with the world around us.

The scientific and technical literature has proposed several definitions of the term "Innovation". In (Zoltan & Audretsch, 1988) the authors define innovation as 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."

Innovation is defined by (Damanpour, 1992) as the "adoption of an idea whether a system, policy, program, device, process, product or service that is new to the adopting organization." Hage (Hage, 1999) specifies that innovation can either be a "new product, service, technology, or administrative practice, apart from the adoption of a new idea."

Geiger and Cashen (Geiger & Cashen, 2002) simplify the definition by stating that "Innovation refers to the creation of new product within the firm." While (De Jong & Kemp, 2003) defines innovation behavior "as all individual actions directed at the generation, introduction and application of beneficial novelty at any organization level."

In 2004, (Palmberg, 2004) defines the concept from a technological standpoint, stating that it is "a technologically new or significantly enhanced product compared to the firm's previous product which has been commercialized on the market." On the contrary, (Fruhling & Siau, 2007) offer a more general definition, specifying that "innovation is an idea, practice or object that is perceived as new to an individual or another unit of adoption."

In 2008, (Dibrell, Davis, & Craig, 2008) point out that "innovation 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."

In 2013, the authors (Edison, Bin Ali, & Torkar, 2013) state that innovation is "production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and

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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."

In 2019, (Dziallas & Blind, 2019) detail that "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."

In 2022, (Ioanid & Iliescu, 2022) proposed another definition, affirming that "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."

2.2. Evolution of the idea of Innovation

Over the years, it can be observed that the definition of innovation has changed, adapting to different conditions, situations, and approaches. Although there are many definitions, there are two characteristics recognized as the base of the innovation concept: the "novelty" and the possibility to manage it.

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).

2.2.1. Open Innovation

As (Valkokari, Paasi, Luoma, & Lee, 2009) present in 2009, the are several partly overlapping concepts for innovation systems and models based on different approaches. Two extremes in terms of innovation are considered: Internal Innovation and Open Innovation. The first one describes clearly defined and closed innovation systems or innovation networks. In the second one, partners can change dynamically or can be unknown. Between internal and open innovation, we can find external and collaborative innovation. Several authors have defined different concepts of innovation that can be classified into these four types.

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 (Caminer, Aris, & Land, 1996), aiming to systematically adopt the user's needs. According to the study published by (Bigliardi, Ferraro, Filippelli, & Galati, 2021), there are up to nine thematic areas in which to apply Open Innovation. Furthermore, through a ten-year study of high-quality empirical evidence in Europe regarding the connections between Open Innovation actions and innovation performance, the effectiveness of this approach is revealed (Greco, Grimaldi, & Cricelli, 2015).

In summary, Open Innovation is described as an internal process that is becoming more dependent on external knowledge and external actors, but it still considers innovation as an internal process (Jesus & Jugend, 2023).

An important specification of the concept of Innovation which is useful in European projects 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

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(Vanhaverbeke & Cloodt, 2014). Open Innovation starts with a large group of ideas and gradually reducing them until reaching the best and most appropriate idea.

Open Innovation begins 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 European projects, it is a collaboration between partners within the Quadruple Helix framework (Carayannis & Campbell, 2012) and, therefore, we are talking about Networked Innovation. The Quadruple Helix model was originally conceptualized by Carayannis and Campbell as a spiral with four strands (Carayannis & Campbell, 2009). The helix clearly demonstrates that the four core components of an innovation system (academia, industry, government, and society) are not involved in unidirectional push-pull relationships, but rather in multi-layered, dynamic, bidirectional interactions. This highlights the role of society as a major actor in national innovation systems as well as the importance of actively integrating the public into innovation projects (Schütz, 2019).

2.2.2. Networked Innovation

To reach the new innovation management approach presented in this paper, 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 (Rehm, Goel, & Junglas, 2016) defines three basic questions that need to be answered to implement a comprehensive information management in Networked Innovation. The three basic questions are *Who?, What? and How?.*

In the context of Networked Innovation, these challenges pertain to the identification and understanding of key aspects that drive successful collaborative endeavors and foster effective knowledge exchange within the network. The *Who?* challenge focuses on identifying and engaging the relevant actors within the Networked Innovation ecosystem. The *What?* challenge centers on discerning the nature of ideas, knowledge, and innovation that circulate within the network. Finally, the *How?* challenge addresses the mechanisms, tools, and processes employed for effective knowledge dissemination and collaborative problem-solving within the Networked Innovation context.

2.2.3. 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). They can be a valuable source of insight into future demands, preferences and behavior (Korreck, 2018). 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 (Freeman, et al., 1968), (Von Hippel E. A., 1988), (Pavitt, 1984).

Several empirical studies have been carried out focusing on different user points of view (Gamble, Brennan, & Mcadam, 2016): user benefits (Tietz, Morrison, Luthje, & Herstatt, 2005), (Hienerth, 2006), (Bonsu & Darmody, 2008), (Füller, Mühlbacher, Matzler, & Jawecki, 2009), and (Harrison, Waite, & Hunter,

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2006); user communities (Jang, Olfman, Ko, Koh, & Kim, 2008), (Casaló, 2008), (Di Gangi & Wasko, 2009), (Bullinger, Neyer, Rass, & Moeslein, 2010), (Hienerth, 2006), (Füller, Jawecki, & Mühlbacher, 2007), (Kim, Bae, & Kang, 2008), and (Algesheimer, Dholakia, & Herrmann, 2005)); user motivations (Füller, 2010), (Lüthje, 2005), (Brabham, 2010), and (Kaiser & Müller-Seitz, 2008); user characteristics (Lettl, Hienerth, & Gemuenden, 2008), (Schreier & Prügl, 2008), (Lettl, Herstatt, & Gemuenden, 2006), (Corrocher & Zirulia, 2010), (Jeppesen & Frederiksen, 2006), and (Oliveira & Von Hippel, 2011).

Therefore, as it can be seen in Figure 1, the User-Centric Innovation approach is an evolution of Networked Innovation, which in turn is a transformation of the Open Innovation approach.



Figure 1. Transformation from Open Innovation to User-Centric Innovation.

3. A New Innovation Management Strategy for European Founded Research Projects

Based on the transformation from Open Innovation to User-Centric Innovation, we define a new innovation approach named "European Project User-Centric Innovation" (EP U-CI). The starting point of this approach is the investigation of user needs. EP U-CI operates on the collaborative efforts of a consortium of partners who utilize a diverse range of tools to meet the needs, demands, and expectations of their customers.

Figure 2 shows the transformation from Open Innovation to EP U-CI, going through Networked Innovation first.

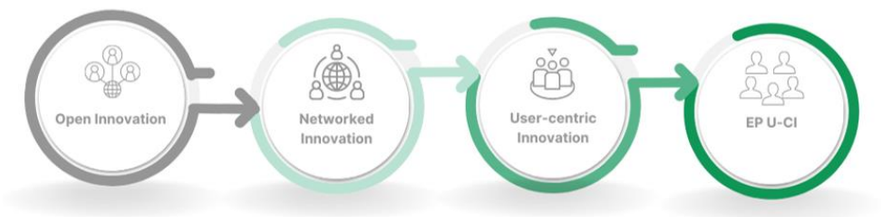


Figure 2. Scheme on how to reach European Project User-Centric Innovation.

The distinct features of EP U-CI lead to important consequences. The paradigm involves two key actor types: users/customers and innovators. It is possible for customers or customer associations to also be innovators, but their role should be considered from a functional perspective.

The differentiation between users and innovators has a significant impact. All actors in the paradigm exchange information, but the nature of this information is now more easily specified. Users communicate their needs to innovators, forming the starting line of the innovators' activities – aiming to satisfy these needs. As a result, innovators formulate technical requirements, which serve as the starting point for designing, implementing, deploying, testing, assessing, etc., the appropriate measures or tools, referred to as Innovation Tools or ITs, to meet the users' needs. Finally, users verify if, and to what extent, the application of the developed ITs has modified their present situation in such a way as to meet their needs. Then these needs can possibly be modified or specified on the base of the new experience, and the cyclic process may restart.

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3.1. Innovation Tools

The concept of Innovation Tools (ITs) is a fundamental one in the proposed strategy for Innovation Management. ITs are the tools, or means, that innovators develop in order to meet the users' requirements. They refer to the diverse set of instruments, methods, techniques, or means employed within the innovation management process to facilitate the creation, development, and implementation of novel ideas, products, services, standards, rules, paradigms, or processes. In one sentence, ITs are the product of the Innovation Process. These tools are used to address specific challenges, foster collaboration, and enable effective problem-solving, ultimately leading to the fulfilment of users' needs and objectives.

From an abstract point of view, ITs can be considered operators in a space of "situations". They transform a present situation (situation "as is"), into a different one (situation "to be"), which advances to satisfy the needs of the users, i.e., achieves the objectives of the innovators (Figure 3).

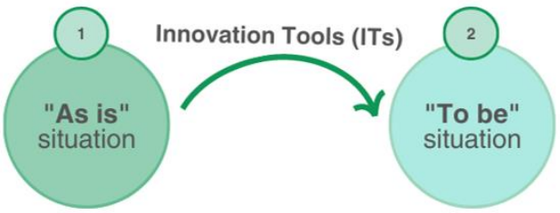


Figure 3. Innovation Tools as operators in a "situations" space.

An Innovation Tool is formally defined as the pairing of a tool and an objective, enabling us to identify user needs and innovator objectives in the current context.

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, pro-positive, etc.

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 an Innovation Process.

4. Case study: IN2CCAM Project

4.1. IN2CCAM Concept and Approach

The IN2CCAM European project (in extenso: Enhancing Integration and Interoperability of CCAM (Connected, Cooperative and Automated Mobility) eco-system) is an Innovation Action referring to the Horizon Europe: 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, that can be applied to investigate a broad variety of user needs (Dell'Era & Landoni, 2014), 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 cocreation 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.

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4.2. IN2CCAM User-Centric Innovation

While the innovation process was generally described as starting from market analysis, applying the new EP U-CI approach, 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).

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, as mentioned above.

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

- The Open Innovation paradigm is a firm-centric one, but it considers the boundaries of the firm 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 Innovation Tools.

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, therefore, 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.

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, pro-positive, etc.

It is important to strictly associate each IT with the corresponding need(s), i.e., innovators' objective(s) it is intended to meet.

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4.3. Innovation Management Strategy

This proposed innovation framework has allowed the definition of this new approach to innovation management. The IN2CCAM Innovation Management Procedure consists of three Actions to be performed in sequence and cyclically iterated during the project, as shown in Figure 4. They will lead to formulate first, and then to complete, update, and specify the catalog of the ITs of the project.

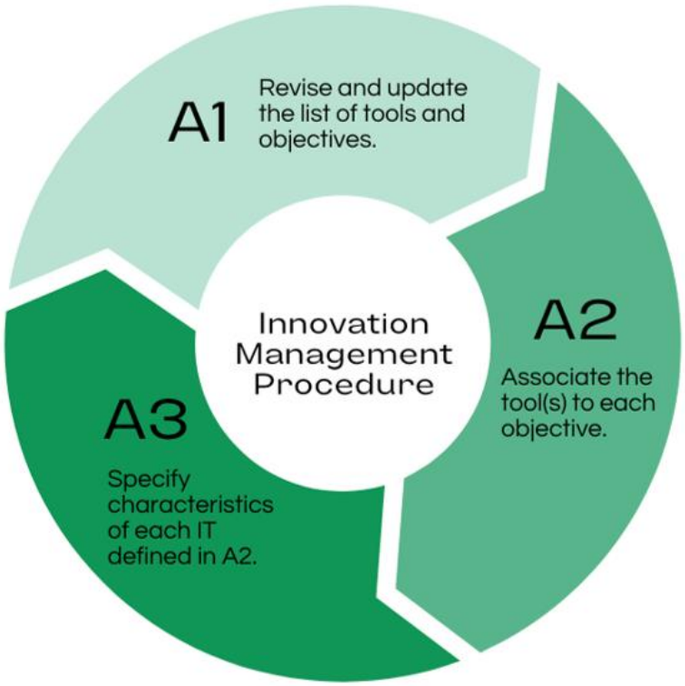


Figure 4. IN2CCAM Innovation Management Procedure.

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.

1. Action A1: revise and update the list of tools and objectives.

The list of tools and objectives have been formulated 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.

Moreover, in the Grant Agreement only CT tools have been indicated, while we want to include also non-ICT ones. 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.

2. Action A2: associate the tool(s) to each objective.

The scope 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 given formal definition.

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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 all Actions will be cyclically iterated thorough the progression of the project.

3. Action A3: specify characteristics of each IT defined in Action 2.

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:

a. The type of the IT: technical, ICT, organizational, administrative, legal, normative, social, governmental, other (specify)
b. Who/what developed/formulated the IT?
c. Estimated costs of the IT:
i. Development
ii. Operation (e.g., per day, per month, or similar)
iii. Other possible costs
d. Who/what operates/applies/enforces the IT?
e. Sketch of the problem/situation addressed by the IT
f. Sketch of the conditions to which the IT is applied in the LL (the "as is" situation)
g. Who/what is affected by the IT (possibly including KPIs – their nature, not values)?
h. How the IT operates?
i. What is required for the scalability of the IT?
j. 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.

4.3.1. Iterative nature of the Innovation Management Procedure of IN2CCAM

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

4.3.2. 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.

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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.

5. Conclusions

This paper delves into the concept of innovation and its various interpretations in different contexts. Innovation is described as a multifaceted term, encompassing both the process of creating and implementing new ideas, products, or methods, as well as the outcomes of such processes. It is acknowledged that innovation can occur in various domains, driving progress and societal evolution.

The main contribution of this paper is the introduction of the innovative approach called "European Project User-Centric Innovation" (EP U-CI), as applied in the IN2CCAM project. EP U-CI places users or customers at the core of the innovation process, collaborating with innovator entities as partners. The concept of "Innovation Tools" is introduced as the means to meet users' needs and objectives.

Furthermore, it is emphasized the iterative nature of the innovation management procedure in the IN2CCAM project. The three actions described (A1, A2, and A3) are to be performed iteratively, allowing for modifications and updates based on the experiences and feedback from the Living Labs.

An illustrative example derived from the IN2CCAM European initiative is presented. In this case study, the Technical Management Team plays an important role in orchestrating and overseeing the innovation management process, ensuring elevated levels of innovation persist among the diverse Living Labs involved in the research project.

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Co-authors Contribution:

All authors have significantly contributed to the development of this study. M. A. del Cacho was responsible for the methodology, validation, and investigation, as well as drafting the original manuscript, reviewing and editing the content, and visualizing the results. M. P. Fanti contributed through manuscript review and editing, in addition to providing supervision and managing the project. W. Ukovich played a key role in conceptualizing the study and conducting the investigation, while also contributing to manuscript review and editing, as well as overseeing the supervision and project administration.

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