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Abstract:

This deliverable is an extension of deliverable D3.1. This evolved version intends to cover proposed methodologies, based on Open Innovation principles from the company perspective and from the cross-synergies approach. This report combines the lessons learnt from the outcomes of innovation workshops (task T3.2) and from other 'cross cluster' projects on EU and regional level accomplished by partners.

Keyword list: Open Innovation, Paradigm application, SME, KPI evaluation method.

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Abbreviations

CLINES   Cluster-based Innovation through Embedded Systems technology – project 320043

IP   Intellectual Property

JAP   Joint Action Plan

KIBS   Knowledge Intensive Business Service

KPI   Key Performance Indicator

ODM   Original Design Manufacturer

OEM   Original Equipment Manufacturer

RIS   Regional Innovation System

1   Executive Summary

This report is related to the company scope of action that describes a proposed approach for applying an open innovation based methodology, taking into account the fundamentals of this paradigm, but also a more practical view learned from the cross-sector experience and research activities.

This deliverable is an extension of deliverable D3.1. This evolved version intends to cover proposed methodologies, based on Open Innovation principles from the company perspective and from the cross-synergies approach. This report combines the lessons learned from the outcomes of innovation workshops (task T3.2) and from other 'cross cluster' projects on EU and regional level accomplished by partners.

2   Introduction

Within the work activities developed under CLINES WP3, the D3.1 report included an analysis on how the Open Innovation paradigm and its adoption could be a key factor for the Regional Innovation Strategy definition, and also from the regional clusters' perspective in order to accomplish their innovation strategies and Joint Action Plan actions.

It was revealed that there must be a relationship and alignment in the forces pushing towards a more comprehensive Innovation Model at a regional level, since this would state an optimal basis for all the stakeholders to be benefitted from the joint efforts and would bring better impacts for the region itself, and the involved members.

One of the key stakeholders of this value chain is the company members, devoted to evolve their business strategy by means of all available tools and methods at hand. This insight was brought about during the CLINES discussions on how to foster collaborations and promote open innovation methodologies among the relevant companies so as to get the ecosystem going (moving/evolving) on the optimal direction.

This was the main driver for the CLINES members to address the need of reflecting how a company, specially an SME, could approach the development and adoption of an Open Innovation Methodology. Moreover, with the aim that it turns out useful and aligned with the company's business objectives and allows its growth within the cross-sectorial and hybrid domain where the Embedded Systems Technologies are the enabler.

The Smart City might be one of these hybrid domains we are referring to, since the kind of smart products and solutions involved are commonly defined by a combination of individual elements, not traditionally produced or developed by one single company or even within the same traditional sector. This shifts the expectations on the outcomes, but also puts higher pressure on the actors involved, that need to find new methods, define collaborative environments and foresee unexpected risks and results.

2.1   *Motivation for the company*

Regarding the inherent motivation and principles of the Open Innovation Paradigm, deliverable D3.1 (Pérez-Sanchez, 2016) already covered the definition of its paradigm and how it represented the key basis for innovation strategy definition.

Chesbrough's book Open Innovation (Chesbrough, 2003) describes an innovation paradigm shift from a closed to an open model. At the heart of this model is the recognition that today, competitive advantage often comes from inbound open innovation, which is the practice of leveraging the discoveries of others: companies need not and indeed should not rely exclusively on their own R&D. In addition, outbound open innovation suggests that rather than relying entirely on internal paths to market, companies can look for external organizations with business models that are better suited to commercialize a given technology.

From [3] it can be derived that companies have historically invested in large research and development departments to drive innovation and provide sustainable growth. This model, however, is eroding due to a number of factors. Chesbrough (Chesbrough and Kardon Crowther, 2006) finds

that many Open Innovation concepts are already in use in a wide range of industries, and documents practices that appear to assist organizations adopting these concepts, discovering that Open Innovation is not ipso facto a recipe for outsourcing R&D.

Most of the literature on this topic has been centred on large technology-based companies, where the notion of open innovation first started. Discussions about the concept of open innovation in small and medium-sized enterprises (SMEs) have been excluded from the mainstream, which results in higher barriers for the more deprived or less resource-doted actors in the field. That is the reason why studies like the one conducted in Korea by Sungjoo Lee et al [4] bring about some light in the dark and motivation for an SME to get focused and determined about adopting open innovation for the prosecution of better and improved business opportunities and results.

2.2   The Open Innovation guiding principles

Open innovation principles were discussed in detail on deliverable 2.1 Methodology on open innovation for the participating regions; therefore this section will be a reminder of those principles in order not to repeat them.

Open innovation can be understood as the antithesis of traditional innovation where research and development activities were performed internally. For this reason, innovation paradigm sifts from a closed to an open model. In this open model, knowledge flows inwards and outwards companies so different businesses can collaborate on the creation of services, products or for commercialisation using both external and internal ideas to create additional value. The following image illustrates open innovation paradigm where knowledge flows are shown.
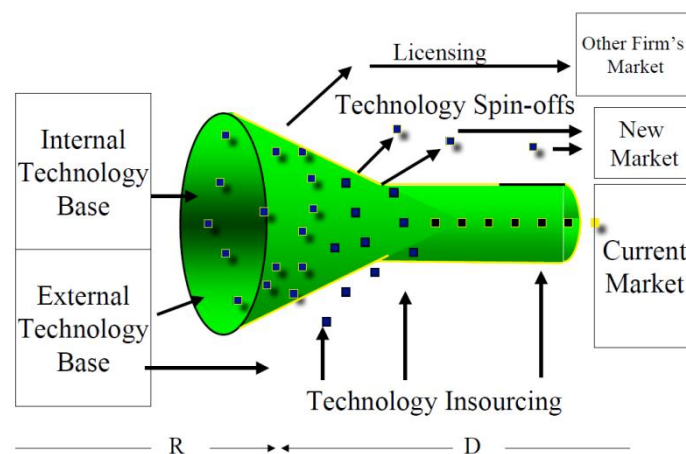

Figure 1: The Open Innovation Paradigm (©Henry Chesbrough)

3   Framework for methodology definition

In most of the cases, companies have access to limited resources that will limit their capabilities. Collaboration with other organisations is an approach that helps them cope with their business goals, especially for SMEs.

Taking into account the two sides of open innovation (exploration and exploitation), the following image shows the relationships SMEs can create in order to be more competitive in both fields (Lee et al., 2010).
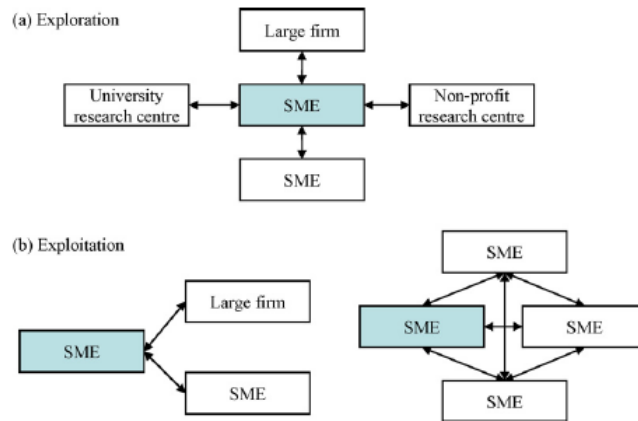
Figure 2: Vision of exploration and exploitation within Open Innovation for a SME

Taking company relations as a starting point, innovation can flow or come in many different ways; all of them depend on the inner capabilities of the involved organisations and their network. If no limitations on the networks are taken into consideration, the following picture is a valuable tool for describing the different takeovers and giveaways that will lead to an open innovation paradigm.

Figure 3: Open Innovation flow as a funnel diagram

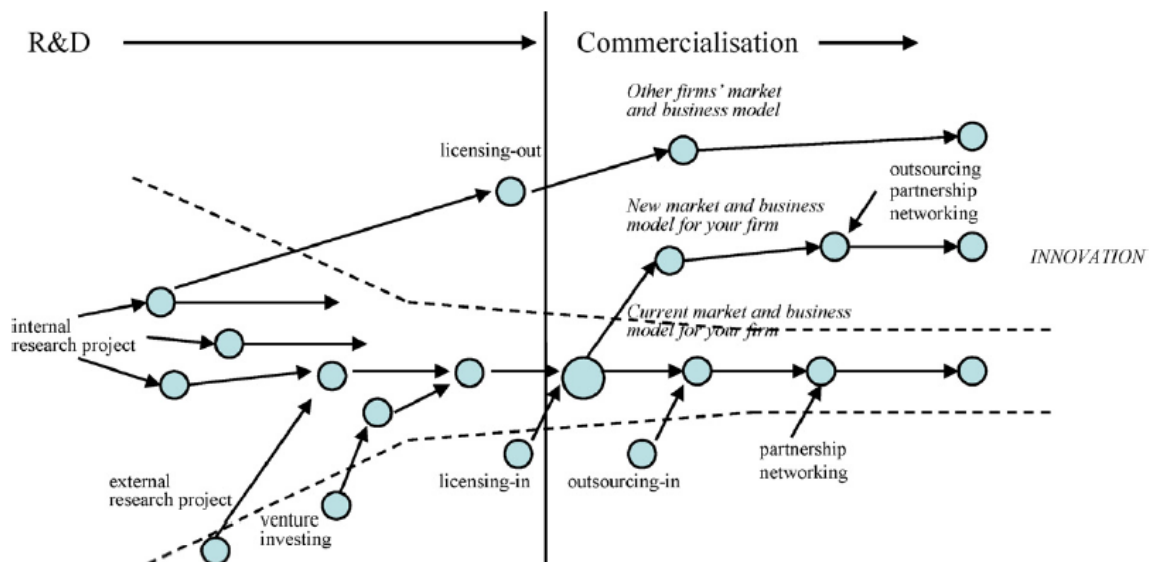Once the type of collaboration between different companies has been decided or identified, the actual work on open innovation will be performed. The funnel graph shown above can be combined with the following actions to create an open innovation framework useful to determine the steps towards open innovation for SMEs.

After analysing the funnel diagram proposed by Lee et al., creating a framework that describes in detail all possible collaborations is a thorough task that would be out of the scope of this deliverable. In fact, collaborations only affect the way a product or a service will be developed or sold and the type of contracts that different companies should sign. In other words, the process and mentality needed in a company to adopt open innovation practices are similar for all cases of possible collaboration. This deliverable will focus on the definition of a general framework that will define the different steps in order to develop an open innovation project. In order to introduce the developed framework, the following image and paragraphs will describe the main processes a company should take into consideration at the time of facing open innovation.
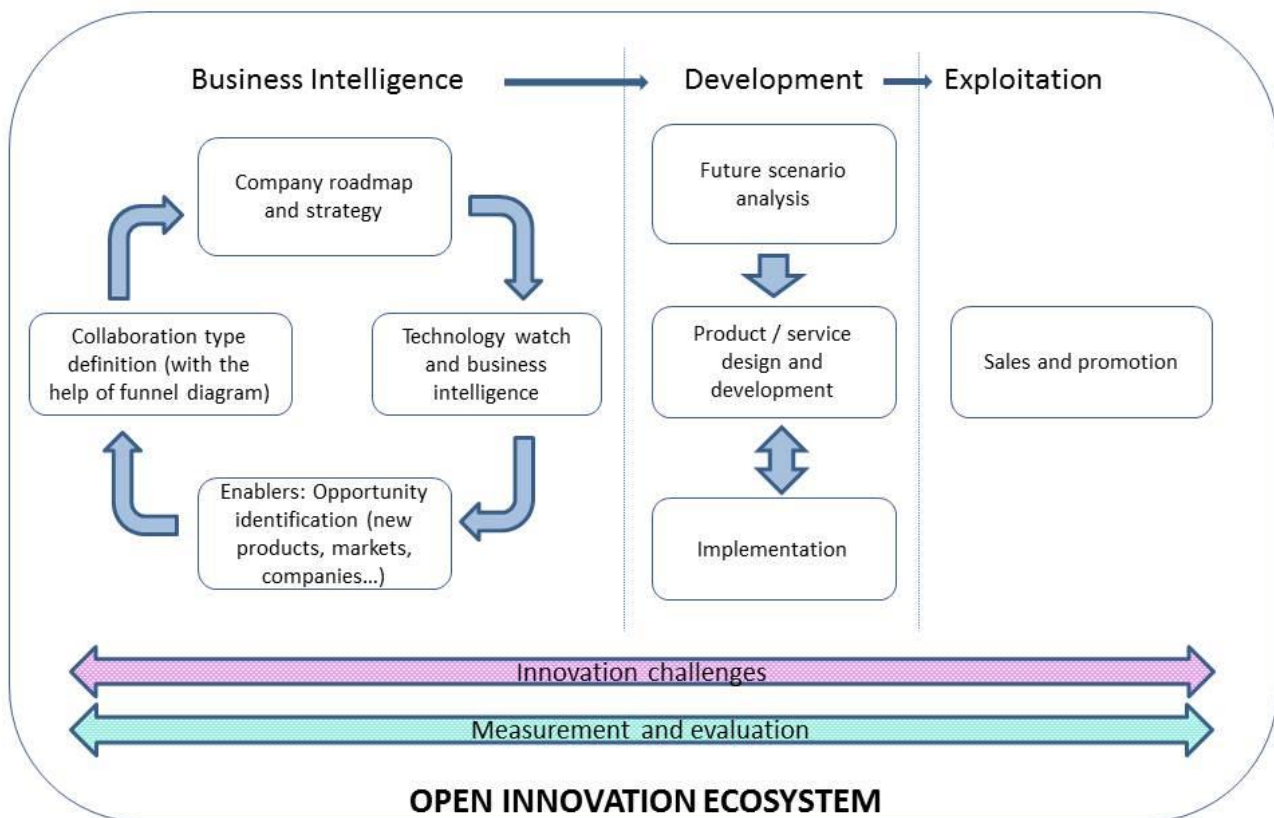

Figure 4: Open Innovation Framework

The picture above is divided in three different columns that represent different business processes or modules that have an influence on open innovation. Those modules and their constituent blocks will be described in the following section.

3.1   *Module description*

Innovation challenges are the challenges that arise from evolving from a traditional innovation paradigm to open innovation techniques. These challenges are present in the whole innovation process and affect potentially the entire institution. According to Chesbrough and Kardon Crowther (2006), there are two main challenges that companies face at the time of adopting open innovation. These challenges are the Not Invented Here syndrome (NIH) and how to sustain internal commitment over the period needed to appreciate the payback from adopting open innovation.

The first of the challenges (NIH) is overcome when companies realise that company's state and achievable efforts are not enough to cut the existing gap to meet the objectives already achieved by external companies.

The second challenge though can be addressed creating or increasing senior management support and funding, creating open innovation champions that will manage the whole process, including new technologies in the company and measuring different metrics to evaluate their adoption.

Apart from the challenges on the adoption of open innovation, there are some other challenges inherent to the innovation process and the disruptive point of view with respect to traditional innovation. The **Innovation Challenges** are represented in the framework picture (figure 4) as a continuous line along the whole process lifecycle. These challenges are described in the following paragraphs.

Project management should turn from a formal resource management to a motivation role. One of the biggest challenges for the management is to foster collaboration and being able to identify business opportunities as projects develop.

Open innovation projects have not as clear objectives as traditional innovation projects do. Instead, some guidelines are introduced in order to facilitate and motivate collaboration. By this mean, objectives are defined on the go and can change as they depend on the collaboration and interaction between different agents. In the same line, "users" should not be seen as mere testers or objects of study. They should take part on the co-creation process and in the development work as they should be the focus of the product to be developed.

Business Intelligence is one of the most important aspects on open innovation. The whole company's approach should be aligned with open innovation in order to be successful at it. Factors as *company roadmap and strategy* should include open innovation policies as they will determine business, human resource management, technology management and communication policies. If the main processes of a company do not include open innovation practices, there will be an obstacle for adopting or spreading knowledge among customers or external companies. It is crucial that Open Innovation gets a key role within the company's strategic plan at mid-long term, so as to be able to accomplish the big effort and challenge that involves adopting a whole new vision and collaborative research implementation approach. Additionally, creating an open innovation ecosystem within the company is a necessary task in order to succeed on innovation projects.

Within the Business Intelligence module we have pictured above several blocks that need to be addressed when establishing first round of objectives and challenges (these might evolve) for a specific innovation project or product:

- *Technology watch* is of paramount importance for any company that wants to innovate; especially for the ones involved in open innovation. One of the pillars of open innovation is to give and take knowledge and ideas; therefore, an appropriate technology watch is fundamental in order to detect possible collaborators external to the company. Apart from the external technology watch, the company should also be conscious of its own strengths and weaknesses if they are looking for partners that will make their position stronger. Once a company is conscious about their potential partners and the weaknesses they want to cover, the possibility to start a new collaboration will appear. Thus, the connection with the following block is triggered

- *Enablers* can be seen as a set of opportunities of different nature that get aligned at a certain point in time so that a specific issue can be deployed. All kinds of resources should not be seen as limited but as a "good" that can be obtained by the interaction of the participants fostering co-creation and the involvement of the partners

- *Collaboration type:* at this point, the funnel diagram presented by Lee et al. (figure 2) is of interest; especially if companies' offer is wide enough to facilitate different classes of collaboration. Ideally, companies will look for partners with experience in the fields where they have weaknesses, creating a collaboration that will benefit all the counterparts. This collaboration definition will be of crucial relevance when determining the commercialisation options afterwards, so from the beginning it is important to envision the final goal of each stakeholder and be able to negotiate collaborative conditions that suit everyone's expectations

The election of the *collaboration type* and partners will determine the steps needed to create a final and releasable product or service. As it has already been mentioned, the analysis of the possible collaboration forms is out of the scope of this deliverable.

The second big module of the afore-introduced framework is commanded by the **Development of the product or service** to offer, for which some steps are of help for the success of the project. Within this process we can distinguish at least three different phases:

- It is important to define the *future scenario* that all counterparts would like to achieve. When collaborating with external companies it is important to define what the outcome from that joint work will be. If the scope of the collaboration is not defined, there is a risk of biasing from the initial idea of the companies and end up achieving undesired outcomes from innovation projects. This phase is the practical link and natural evolvement of the previous block. For most of the *product or service development* collaborations, once a future scenario has been determined and each participant's contributions are defined and agreed, the actual development will take part

- *Product/Service design and development*: this block is the most common one for a company that has experience in the development of a product from scratch. It could be approached from diverse perspectives, from traditional to more innovative management. As mentioned in the challenges description, project management should adapt to open innovation and try to effectively integrate the work by different companies and stay aware of new opportunities that may came out of the project development

- *Implementation*: this is the most practical activity, the phase where all collaborators and actors get to implement what they have agreed, and establish the required integration objectives so as to finally obtain the desired product or service. Commonly this would be a circular phase, where more than one round is needed to optimally finalise the integrated product/service and get a market-ready solution to be put into the commercialisation phase

Exploitation is the third module of the framework and represents the bigger challenge for most of companies. It is obvious that the inner goal of a company is to make profit through all its open lines of products and services. A company is required to confront the market, and normally the whole vision and strategy is declined to serve that huge objective. So, Open Innovation is not an exception. Open Innovation needs to be a good means towards that company goal. The whole process needs to be materialised in a new business line/product/service that opens or extends opportunities for the company, in terms of market share increase, or approaching new market sectors, or new customers, or internationalisation… The specific commercialisation objectives would derive in different business agreements and collaboration types. This module is well linked with the first phases of collaboration establishments, since IPR and exploitation rights need to be negotiated and agreed upon from the beginning to avoid misunderstandings. Of course, Open Innovation based initiatives are constantly alive and evolving, so this may also be re-negotiated along the process, but several initial positions need to be defined as starting point. During commercialisation, a whole proof is tested towards the market, so all stakeholders are under the test of the users and clients.

During the whole Open Innovation process lifecycle there is another counterpart, represented in the framework by a double arrow named **Measurement and Evaluation**. Each of the modules described above have connections among one another, and their constituent blocks influence and may provide feedback for diverse phases of the whole process. But, the project management would be blind if no measurement procedures are available. Open Innovation processes are always linked to establishing an evaluation system that allows to measure and analyse the process itself. It is relevant to define Key Performance Indicators for the different phases, so as to be able to track which specific decisions or actions get better results: from the cross-collaboration team management, to the business related indicators. There is a need to evaluate and analyse the causal relations between what has been done and how, and the obtained results. Control points on Open Innovation are not as restrictive and should not be pre-set. Establishing control points would limit the project and possible new products or solutions would not be noticed due to the lack of flexibility, but Performance Indicators that are revised all along the process will help to correct deviations and have a clearer view on the accomplishment of final objectives/results.

The following section describes in more detail the Impact measurement and evaluation.

3.2   Impact measurement and evaluation

3.2.1   Open innovation perspective

As this report is discussing Open Innovation from a company perspective, this paragraph on impact measurement and evaluation is taking a company's strategy as starting point. A company is set up to create specific economic and societal added value. In the most optimal situation, company shareholders and management have a specific vision, develop an actionable mission, translate this mission into smart objectives and define a set of strategic actions which are then converted into manageable activities which can be implemented on an operational level. This whole process takes

place in a competitive environment in which other stakeholders (e.g. customers, suppliers and competitors) are working hard to realize their mission and objectives. Within the open innovation paradigm, collaboration is put forward as a mean to reinforce companies and to involve other stakeholders in creating (mutual) added value.

Numerous methodologies with regard to business planning and strategy development are discussed in management literature. Most of them discuss at a certain moment in the definition of SMART objectives: Simple, Measurable, Achievable, Realistic and Time-bound objectives. For example, one of those methodologies is the OGSM model. This method combines company objectives with actions/strategies to realize those objectives and measures to track progress. In case a company finds Open Innovation of strategic importance to realize the company mission and objectives, some of the strategic actions must be related to open innovation. Those strategic actions can be related to:

- Product and/or service innovation: e.g. involving companies with specific expertise to fill a competence gap in the product development process,
- Process innovation: e.g. outsource a specific part of production to further optimize product/service delivery
- Market innovation: e.g. set up a joint venture with a company to enter a new market

For each type of those strategic actions the activities can be broken down according to the OI modules (business intelligence, development, exploitation) as described above.

Figure 5: OGSM: Example of a strategy methodology combining Objectives, Goals, Strategy and Measures.

3.2.2   Measurement perspective

Measures can be related either to inputs, activities, outputs, outcome and impact. Together they compose the 'impact value chain' (Hehenberger, Harling and Scholten, 2013). This impact value chain is closely related to the value creation process proper to each company: converting inputs, through an efficient process into tangible outputs which are worth paying for by customers. Inputs, activities, outputs, outcome and impacts can be defined as follows:

- Inputs: all resources, whether capital or human, invested in the activities of the organisation.

- Activities: the concrete actions, tasks and work carried out by the organisation to create its outputs and outcomes and achieve its objectives.

- Outputs: the tangible products and services that result from the organisation's activities.

- Outcomes: the changes, benefits, learning or other effects (both long and short term) that result from the organisation's activities.

- Impact: the attribution of an organisation's activities to broader and longer-term outcomes.

Where measurement of inputs, activities and outputs can be difficult but feasible, measurement of outcomes and impact can be much more complex as the causal relationship with the pervious elements of the impact value chain is sometimes not that clear. To accurately (in academic terms) calculate outcome and impact, one has to take into account:

- what would have happened anyway ("deadweight");

- the action of others ("attribution");

- how far the outcome of the initial intervention is likely to be reduced over time ("drop off");

- the extent to which the original situation was displaced elsewhere or outcomes displaced other potential positive outcomes ("displacement"); and for unintended consequences (which could be negative or positive)

3.2.3   Usage perspective (Erkens et al., 2014)

The mere provision of a performance measurement system through the collection of appropriate management information is itself no guarantee of successful innovations. This information feeds the complex process of managing innovation, aligning stakeholders and balancing needs, constraints and objectives. Metrics can be utilized on three different levels: instrumental, conceptual and symbolic.

- Instrumental use refers to the application of information or metrics used directly for decision-making. For instance, when the OI project is cancelled because the metric "expected sales" is below a specific threshold, the metric was used instrumentally.
- A more indirect use is the conceptual one. The use of the information or metric does not directly lead to a concrete action, but rather provides general enlightenment and understanding. For example, when a manager recognizes that the lead time of OI projects is on average 30% lower than for conventionally run innovation projects, they are using the metric "lead time" conceptually.
- Metrics can also be used after decisions have already been made to legitimize and justify them. This kind of use is called symbolic. If an OI project is cancelled due to cost overruns,

the official reason for its termination is "quality of ideas" — this metric is used symbolically.

Measuring the impact of open innovation action is a complex technical topic embedded in a complex environment of innovation, change, failure and success. By adding the 'usage perspective' the loop is closed. Starting from the vision of company stakeholders, this vision was translated into concrete open innovation actions which probably are implemented, measured and reported back to decision makers and company stakeholders. Open innovation is part of an iterative process which drives a company forward. The 'Usage perspective' is mentioned to make the 'measurement framework complete but will not be discussed in more detail in the remainder of this report.

Figure 6: Impact management actions

3.2.4   Measurement and evaluation framework

The figure below combines the Open Innovation, Measurement and Usage perspective into one view. Such canvases are valuable tools to bring structure into chaotic strategy development and implementation processes. They offer a structure but also make abstraction of business reality by trying to frame this reality into a canvas. This framework has to be used 'conceptual' to gain more insight into the impact of open innovation on the business of a specific company.
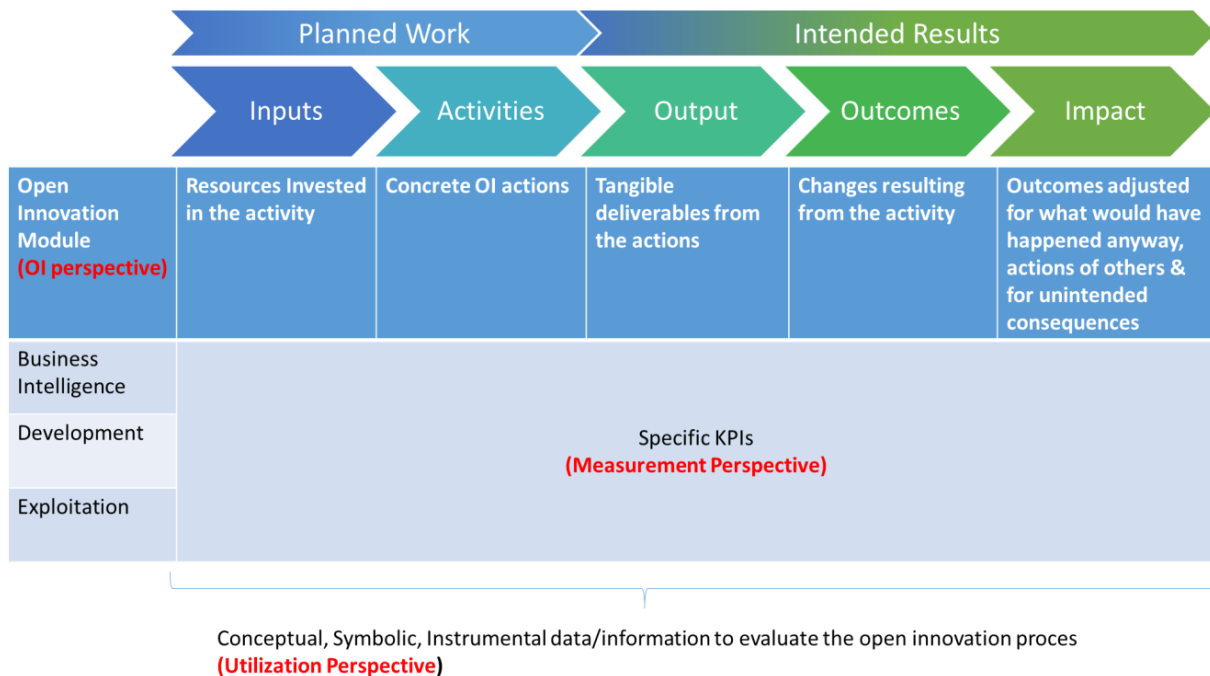

Figure 7: Measurement and evaluation canvas

How to apply this framework into reality will be demonstrated in chapter 4 of this report. By applying the OI framework to some 'Smart City' cases the use of OI can be further clarified.

4   Practical cases

4.1   *Open innovation in urban areas*

An urban area is characterized by high population density and infrastructure. They are areas where people live, work and enjoy their spare times. People playing different roles within different (in)formal organizational structures. Smart systems can enable solutions which make living in urban areas more efficient, effective and enjoyable. Smart Systems are key building blocks to connect people and things, gather relevant data and trigger action. Implementing smart systems into an urban area requires collaboration between people with different expertise, background and roles. Companies aiming at exploring and exploiting solutions for urban areas enabled by smart systems technology are – almost by definition – obliged to adhere to an 'open innovation' vision for their activities.

To make the above described theoretical concepts more comprehensible, the X-Inno (BE) and the SmartKalea (ES) are described in this paragraph. Both cases only address part of the open innovation framework. The X-Inno cases focuses on business intelligence whereas the SmartKalea case is more related to the development module of the open innovation framework. It is necessary to point out that none of the partners of CLINES took part in the development of SmartKalea; therefore, the approach and the description of the project will be based on the data available from the different partners involved in the project.
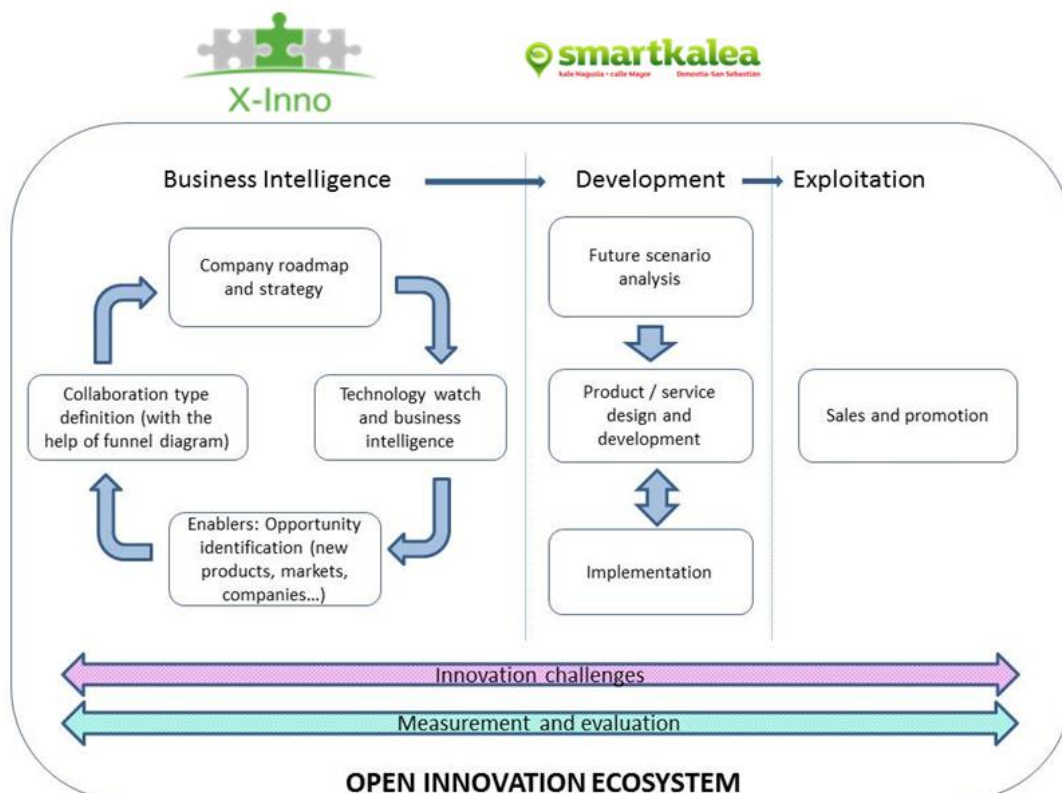

Figure 8: X-Inno and SmartKalea projects fit into described open innovation framework

4.2   X-Inno Approach – Flanders

4.2.1   Description

The development of the X-Inno approach started from the vision that huge business opportunities exists on the interface between different domains but that X-ecosystems, X-discipline, X-sector collaboration is needed to create value from those opportunities. Furthermore, this type of collaboration can be catalysed through intermediaries. The X-Inno has been developed to support those intermediaries in developing X-Inno activities aiming at exploring and exploiting innovative solutions on the interface of different domains. The

The X-Inno approach has been bootstrapped under the EC funded project N4H which aimed at bringing the electronics and life science ecosystem together to collaborate on new applications for personalized healthcare. During this project an operational framework for X-Inno activities was developed starting from 5 key principles:

1. The X-Inno approach has to accommodate for multi-stakeholders, multi-discipline, multi-sector collaboration.

2. The X-Inno approach has to follow a lean and iterative approach allowing for learning by doing and pivoting.

3. The X-Inno approach has to apply creative techniques to co-inspire and co-innovate.

4. The X-Inno approach has to allow for framing challenges, connecting with partners, cross pollinating across partners and to co-create tangible solutions

5. The X-Inno approach can catalyse cooperation or help to coop with market inefficiencies by granting financial resources but the key driver for collaboration must be a sound business case rooted in a concrete market opportunity.

During the development of this operational framework the X-inno approach was never linked with the Open Innovation paradigm developed by Henry Chesbrough. However, the analysis which preceded this deliverable showed that the Open Innovation paradigm could be easily matched with the X-Inno approach. As such the X-Inno approach could be seen as an approach to operationalize Open Innovation. The insights developed during the N4H project led to the definition of the 3 OI modules described above. In the figure below those 3 modules are mapped on the operational X-Inno framework which was originally developed.
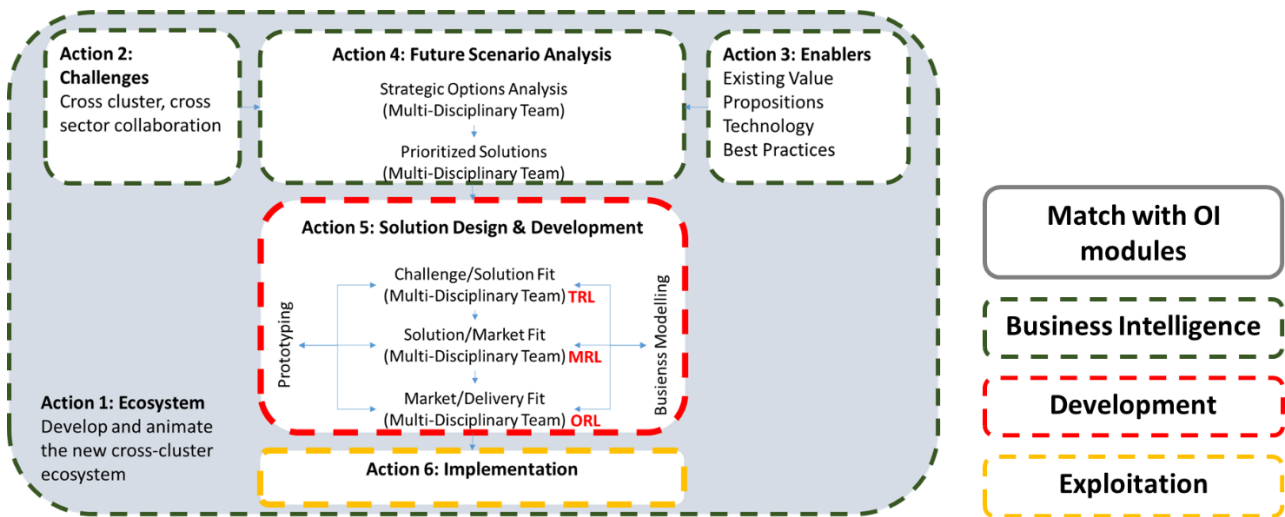
Figure 9: X-Inno modules fit into open innovation framework

Besides developing the X-Inno Framework the N4H allowed also to validate part of the framework in practice. The development activity was put in practice leading to 6 concrete projects which in total established 24 collaboration agreements with competence providers who supported the project owners in increasing the technology, market and/or operational readiness level of the projects.

The CLINES project offered the opportunity to further elaborate on the Business Intelligence part of the X-inno approach and to validate the X-Inno Business intelligence in a context of smart systems for urban regions.

4.2.2 Positioning the OI module business intelligence

4.2.2.1 Matching the X-Inno approach and OI business intelligence

The core actions of the X-Inno approach which are related to business intelligence are:

- *Action 1: Develop and animate the new cross-cluster ecosystem.*
  The <u>core objective</u> of this action is to create this new emerging ecosystem and to develop the necessary support measure to let this ecosystem flourish. Activities under this program are, amongst others, related to management of the X-Inno approach, communication, access to funding, stakeholder involvement, event organizing, etc.

- *Action 2: Gather intelligence about a specific application domain.*
  The <u>core objective</u> of this action is to gather insight in unmet needs and challenges which could be solved by an X-discipline, X-sector value proposition.

- *Action 3: Gather intelligence about enabling technologies.*
  The <u>core objective</u> of this action is to gather insight and knowledge about state of the art enabling technology and to gather insight in other relevant technologies (e.g. Advanced materials, photonics, etc.) in case those technologies are applicable to a specific application domain.

- *Action 4: Develop a set of prioritized solutions.*
  The <u>core objective</u> of this action is to match unmet needs and challenges with solutions enabled by specific technology. The list of prioritized solutions can range from short term solutions to concrete issues to moon-shot projects which aim at tackling specific challenges

in a profound way. A systems thinking approach is required to gain insight in potential impact of suggested solutions and relationship with other influencing parameters.

All those actions deliver key information for companies to develop a strategy for an X-inno activity, to prioritize certain market opportunities, to gather relevant information on which technology can enable solutions for a specific market, to shortlist key partners with whom can be collaborated to explore and exploit smart systems enabled solutions for urban regions. Although relevant, gathering this information and translating it into an actionable strategy is already a huge challenge.

4.2.2.2   Validating the X-Inno business intelligence actions

The CLINES project allowed for validating part of the X-Inno business intelligence activities. Some of the above mentioned business intelligence actions were translated into concrete activities aiming at defining and prioritizing concrete challenges which could be further elaborated and developed into concrete smart systems solutions by a group of engaged stakeholders.

Activity 1: Moon-shot workshop

This workshop was a first effort to implement 'Moon-shot thinking' in an X-Inno smart cities context and aimed at identifying "moon-shot challenges" for our cities: finding ambitious and exploratory project initiatives to improve the future of our urban lives.

A heterogeneous group of professionals was mobilized for this workshop to have input from as much as domains as possible: academia, pharmaceutical industry, food industry, technology companies, fashion industry, cities, etc. In total about 55 people assisted to this 'moon-shot' workshop.
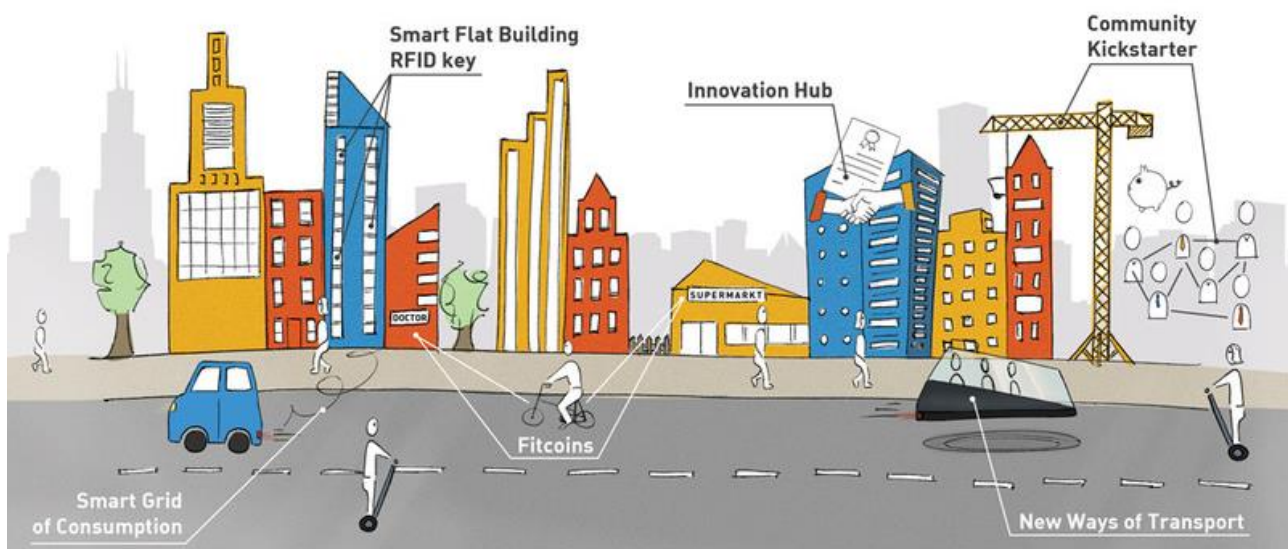
Figure 10: X-Inno smart city concept

During this moon-shot workshop 6 moon-shot challenges were defined:

- Smart grid of consumption
- Smart Flat Building RFID key

- Fitcoins
- Innovation Hub
- New ways of transport
- Community Kickstarter

Activity 2: Survey

The results of the workshop, ic. the 6 moon-shot challenges, were the basis for developing a survey which was sent to the participants of the workshop and which aimed at :

- gathering additional information on: Additional ideas related to the 6 moon-shot challenges, stakeholders which need to be involved in the development of the solutions
- keeping the participants involved in the 'business intelligence' process
- initiating the learning process which is key to develop innovative solutions
- prepare the follow on workshop.
- gathering feedback on the concept of the moon-shot workshop

The survey was answered by approximately 20% of people who attended the moon-shot workshop. Based on their answers 3 out of the 6 moon-shot challenges appeared to be the most popular. The 3 challenges which were selected for discussion during the follow on workshop were:
- The Fitcoin Platform: This platform interconnects different actors, products, service providers, professionals, etc… around physical and mental health, fitness and medicine. (people, patients, doctors, nurses, dieticians, personal trainers, …) It's main goal is to enable people who want to improve their "health status" (obese, …) to do this in a positive ,active and supportive manner. "Fitcoins" is a currency which would enable the transfer of value on this platform. So by working out a half an hour for example, a user might be able to buy healthy food at a local grocery store. The value generated by Fitcoins could have a big impact on national social safety nets.
- The Smart Flat Building: This concept tries to tackle loneliness and the lack of joint activities in cities through architecture and technology. It's goal is raise connectedness and diversity within urban areas. Imagine: Sam moves to a new city and rents an apartment in one of the cities smart flat buildings. When he arrives after a long day of work he opens the front door with his RFID-key. The smart building now knows that he's home and invites him to have talk with one of his neighbours who has very similar interests. Sam likes the idea and goes further, he looks up all the people in the building with those interests and lets the building invite them to a themed BBQ for all to enjoy and talk.
- The Smart Grid of Consumption: In this concept, we aim for complete transparency of production and consumption of all kind of resources (energy, nutrients, etc.). Awareness is the key and first step to tackle any problem. By revealing and democratizing energy production for example, we enable communities to formulate informed ideas for sustainable improvements on various levels. (e.g. water purification system on community level).

Activity 3: Follow on workshop

The Follow on workshop was organized 2,5 months after the moon-shot workshop. Not only, participants to the moon-shot workshop were invited to this workshop but also a selection of entrepreneurs who are developing solutions related to the 3 selected moon-shot challenges. This workshop was organized as an open workshop which used the results from the moon-shot workshop, the survey results and the inspirational testimonials of the entrepreneurs as input. This

follow on workshop aimed at prioritizing the moon-shot challenges and mobilizing stakeholders for further elaborating on the challenges and related solutions.

4.2.3   Measures to monitor the OI activities

Company strategy

The X-Inno approach has been developed for intermediaries who want to facilitate X-domain innovation. Those intermediaries could be for example a cluster organisation[1] which is managing a cluster initiative[2] and has the following mission: to improve the competitiveness and accelerate the growth of the smart systems cluster[3] by setting up activities and services that support the cluster in:

- Building emerging and cross-disciplinary value chains
- Getting access to the international and global market
- Getting access to the required resources: technology, competences, money

Applicable OI measures

How the X-Inno approach contributes to the realization of this mission can be monitored by a structured process of measuring and reporting on performance indicators. Taking into account the above mentioned business intelligence activities (moon-shot workshop, survey, follow on workshop) the following measures could be used. **Note**: the table below focuses on the business intelligence module, as the activities in this X-Inno case only relate to Business Intelligence and not to the development of deployment module of the OI framework described above.

Table 1: Applicable OI measures to X-Inno project

BI Activity	Moon-shot workshop	Survey	Follow On Workshop
Inputs	Number of Manhours to prepare and run the workshop Direct Costs (e.g. location)	Number of Manhours to prepare and analyse Direct Costs (e.g. Survey tool)	Number of Manhours to prepare and run the workshop Direct Costs (e.g. location)
Activities	Nb of participants. Heterogenity/complementarity of the participants. Quality of the location Quality of the discussion/presentation	Nb and quality of answers. Quality of additional input with regard to the challenges Nb of comments	Nb of participants Heterogenity/complementarity of the participants. Quality of the location Quality of the discussion/presentation

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[1] A Cluster Organisation provides services to cluster initiative participants.

[2] A Cluster initiative is an organised effort to increase the growth and competitiveness of a cluster within a region, involving cluster firms, government and/or the research community.

[3] A cluster is a geographical proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and externalities. (Michael E. Porter, On Competition)

Outputs	Nb. Of Moon-shot Challenges Net promoter score	Nb of surveys answered. Completeness of surveys answered Relevance comments	Nb. of people who express their engagement to further collaborate on a moon-shot challenge. Net promoter score Nb of Ideas Idea feasibility
Outcome	Emerging Value chains Optimized cluster branding Stakeholder satisfaction	Optimized branding Increased stakeholder involvement Opportunities for follow up activities.	Increased feeling of ownership/involvement. Emerging value chains Opportunities for follow up activities
Impact	Overall impact on competitiveness: measures related to institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation (World economic forum, 2016).		

How X-Inno business intelligence activities contributes to the mission of a cluster organisation.

By adding outcome and impact measures to the evaluation framework operational BI intelligence can be linked with the strategy and the mission of the cluster organisation. It is important to also link activities from other OI modules closely together and relate them to the overall outcome and impact measures of the cluster organisation. For example:

- It is one of the key objectives of a cluster organisation to develop new and emerging value chains. The BI activities in this case result into ideas for new value chains. To create tangible impact one has to monitor if those ideas are developed into concrete ideas and new products and services and will create sustainable business (develop and exploit OI module)
- Furthermore the collaborative BI activities as described above are small steps to increase e.g. the technology readiness, business sophistication and innovation capabilities of the stakeholders involved. This adds up to increasing the competitiveness of the full cluster in the long term: the mission of the cluster organisation.

Concrete facts and figures on above mentioned (and other measures) are valuable for communication purposes, either conceptual, instrumental or symbolic. A cluster organization has several key stakeholders. Amongst them: companies, government and academia. Abovementioned measures will clarify the added value of a cluster initiative for all those stakeholders involved.

4.2.4　What's next

From the perspective of the CLINES case

Key challenge is how to continue with elaborating on the 6 moon-shot challenges. The key issues here are team and funding. In OI terms how to go from the business intelligence module/phase to the development phase.

Ideas: organisation of workshops to keep the ecosystem going, develop some value models and business plans for some of the challenges, acquisition of funding through grants and subsidies.

From the perspective of the X-inno approach

Develop a X-inno document consolidating the experience and insights from as well this CLINES case as the N4H project. Launching new X-inno activities either related to business intelligence, development, exploitation of a combination of those OI modules.

4.3　SmartKalea Case – Basque country

This section will describe the process that should have been followed by the authors for the case of the implementation of the SmartKalea project in the city of San Sebastian. SmartKalea is a project where different meters are used in a street in order to increase energy efficiency in both public and private establishments.

4.3.1　Description

SmartKalea is a project developed in the city of San Sebastian. A central street was selected in order to promote environmental sustainability, energy efficiency, citizen participation and transparency. For this purpose, San Sebastian city council, as coordinator, and technology providers collaborated closely so that they could create the necessary environment that would enable the achievement of the main objectives previously mentioned.

Going into detail, city council wanted to decrease energy consumption in the street so they wanted to analyse existing luminary system efficiency, get information on the usage of streets and commerce in order to adapt existing services and offer advice to different establishments so that they become more energetically efficient and finally, achieve a better energy efficiency in housing.

4.3.2　Positioning the OI module business intelligence

Business intelligence is not exclusive to companies as can be verified in the case of SmartKalea where a city council develops its strategy depending on the technology and possibilities provided by external companies that have no relation with the council itself. This fact is a clear indicator of open innovation and openness to collaboration attitude by a city council and denotes a technology watch process that enables the ideation of projects otherwise unachievable.

Compared to a company, a city council should also have a "city roadmap" similarly to a company roadmap and strategy where the kind of city to have in the future is described. In this case, San Sebastian city roadmap considers creating a more energy efficient city in the future. With that

purpose in mind, San Sebastian city council contacted companies that are part of the SmartEnergy cluster. By this mean, they made sure that the companies they contacted were working on the appropriate field for their main objectives. Technology partners get access to a live laboratory where they can test and show their technologies and capabilities creating a win-win environment attractive for both counterparts. Local commerce are using ICT provided data as a means of boosting the stores, disseminating data among citizens and improving their energetic efficiency derived from consumption data captured by smart meters. Citizens can also adhere to this project and allow the installation of smart metres in order to receive data on their consumption and advice on how to adapt their habits and households for a more sustainable consumption.

As it can be seen, San Sebastian city council ideated an environment where all counterparts could get benefits thus creating a favourable setting for collaboration.

4.3.3   Positioning the OI module development

Once possible collaborators have been detected, understanding all partners' expectations is crucial in order to develop a common roadmap that will lead to the definition and implementation of the project. One of the biggest advantages at this stage is that city council objective (increasing efficiency) is aligned with the field of collaborating companies as they are part of the SmartEnergy cluster. This common topic is of importance at the time of creating cohesion between the involved partners; all of them work on the same field even if their knowledge and technological base are different and a close collaboration can lead to the success of the project. Additionally, all companies can show their capabilities as well as contact possible collaborators for new projects.

As project promoter and final user, San Sebastian city council job is to clearly define and formulate its objectives and desired future scenario. A detailed definition is not needed because collaboration between different companies is easier if boundaries are loose; moreover, future scenario definition will be richer if all involved counterparts take part on its definition based on the existing problems on the city. One of the existing problems from SmartKalea project comes from is the need of more efficient lighting on the street; a problem that relapses only on the hands of the city council and can face at their will. As explained above, increasing energetic efficiency is of interest for different shops, businesses and citizens on the area as well; therefore the potential number of customers increases exponentially if the technologies and offered services are affordable. With the exposed points in mind, the future scenario proposal for this project might have been a statement of the form: "achieving a low energy consumption environment in the street adapting lighting scheme, devices and shop opening times depending on the usage (pedestrians) of the street". This statement opens the door to all involved partners to offer their products, services and knowledge in the field of energy efficiency and define the kind of services and products to integrate in order to get close to the described goal.

With a clear goal and problem in mind, different techniques can be used for the definition of possible solutions. The explanation of problem solving techniques is not on the scope of this deliverable therefore methods used at this stage will not be explained. What is certain is that all partners took part in problem solution and all proposed the usage of different technologies to achieve the proposed goal and other value added solutions. An example of direct usage of technology is the change of traditional lighting to led bulbs, a technology that saves energy itself in comparison with other equipment. At the same time, led bulbs were combined with sensorised streetlights so that they would lighten up when pedestrians are around thus increasing the energetic efficiency of the street lighting system. Another example of direct use of technology is the

installation of water flow restrictors in homes with the aim of reducing water consumption; according to media reports, installing flow restrictors and low energy consumption bulbs reduced the amount of energy consumed in housing by 12% and up to 50% for the case of some businesses (Zabaleta and Estrada, 2016). There are also examples of indirect usage of technology as is the case of use of data from pedestrian counting systems to offer shops advice on when their storefronts should be lightened up or when to use cooling systems. This examples show that apart from limiting to the providing technology, there was a deeper consideration of how devices and information can be used in order to offer value added services to different clients and decrease energy consumption. The second type of example also denotes collaboration between different partners, namely people counting system providers and data analysis teams as well as gadget or technology providers have to work together in order to offer a reliable and valid answer to specific shops or home's needs. The type of work performed to carry out SmarKalea project fits perfectly with the modules proposed in the framework for methodology definition section: there is a future scenario analysis and a problem that needs to be solved, different companies take part on the problem solving phase and apart from providing technology only, new answers are found in order to offer value added services that were not in the original scope of the project.

In a project as extensive as SmartKalea, different products and services are developed and collaboration between different partners is crucial for the success of the project. The following section aims at defining measurements in order to evaluate collaboration between different partners.

4.3.4   Measures to monitor the OI activities

As SmartKalea project focuses on offering services and products to users (businesses, homes and city council), this section will focus on the measurement of development and exploitation of open innovation activities, as previously explained example (X-Inno) already analysed strategy based measures.

Applicable OI measures

Table 2: Applicable OI measures to SmartKalea project

BI Activity	Future scenario definition	Product/Service design and development	Implementation
Inputs	Number of man-hours to define future scenarios Direct costs	Number of man-hours to design and develop products and services Direct costs Previously developed technology	Number of man-hours to implement developed products Direct costs
Activities	Complementarity of the participants Number of participants Creativity activities carried out	Complementarity of the participants Number of participants Creativity activities carried out	Different technical implementations Database compatibility activities Number of customer information activities

			carried out
Outputs	Number of future scenarios analysed Detail of the description of future scenarios	Number of new products and services	Number of installed products Number of offered services
Outcome	Opportunities to integrate different partners	Number of collaborations with different industries New market finding	Training on new technology
Impact	Involvement in multidisciplinary teams enlarging collaboration opportunities Alliances with new companies	Openness to new markets Collaboration with complementary companies	

Comparing the measurements for the development module with the ones described in the previous section, centred on business intelligence, one of the main changes appears on the outputs and outcomes of the activities. As it is normal, indicators are related to tangible outputs at this point of the project.

5   Conclusions

In this deliverable a framework for Open Innovation has been presented. The methodology has been developed from the point of view of a company; thus a lot of opportunities exist at the time of defining collaborations as seen in the funnel diagram. With such a wide range of collaboration types it may be difficult for newcomers to choose the most appropriate one but in the other hand a wider range of opportunities create an open environment where companies are predisposed to collaborate.

Even if there is a strong company point of view on this deliverable, company's environment is of paramount importance and if a company is not acquainted of its surroundings, it may miss collaboration opportunities. As mentioned in "framework for methodology definition" section, open innovation should be included in the company strategy in order to consistently and constantly taken into consideration. If open innovation is to be performed in an organisation but it is not present in their strategy, open innovation practices are prone to not be a continuous practice.

Innovation impact measurement is other of the pillars in order to maintain open innovation practices over time. When different companies collaborate to develop a common project both tangible and intangible outputs should be taken into account. One of the pillars of open innovation is collaborating to reach new markets or create products that would be impossible otherwise. Measuring the quality of collaboration or identifying new markets and quantifying them is not straightforward. Therefore, attention must be paid to different indicators; indicators that are not common to all businesses as different companies rely on different measures according to their objectives. Two examples of this different measures are the practical cases were different phases of open innovation have been analysed. As it can be seen, different development phases require different indicators that should also have coherence in between them.

All in all, open innovation should be treated as a strategy for the development of a company even if it depends highly on collaborations and can be seen as unstable. Open innovation measures are dependent on company's strategies thus there is not a recipe valid for all cases and companies should work on meaningful indicators for them.

The case studies involved showed us that this open innovation framework is applicable to a Smart Cities context too. X-Inno as well as Smart Kalea cases demonstrated the match between an innovative project in a city context and the OI framework.