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Abstract:

This deliverable covers the definition and principles behind the Open Innovation paradigm, as well

as a proposal regarding the application of Open Innovation methodologies for each of the participant regions in the CLINES project.

Keyword list: Open Innovation, Paradigm application, Participant Regions.

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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 regional level that describes the basic characteristics of open innovation with the fundamentals of this paradigm.

This deliverable covers the definition and principles behind the Open Innovation paradigm, as well as a proposal regarding the application of Open Innovation methodologies for each of the participant regions in the CLINES project.

2 Introduction

2.1 Definition of Open Innovation

The Open Innovation paradigm can be understood as the antithesis of the traditional vertical integration model where internal R&D activities lead to internally developed products that are then distributed by the firm. If pressed to express its definition in a single sentence, open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology. Open Innovation processes combine internal and external ideas into architectures and systems. Open Innovation processes utilize business models to define the requirements for these architectures and systems. The business model utilizes both external and internal ideas to create value, while defining internal mechanisms to claim some portion of that value. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value.

The Open Innovation paradigm treats research and development as an open system. Open Innovation suggests that 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 to market in the earlier era.

Open Innovation is sometimes conflated with open source methodologies for software development. There are some concepts that are shared between the two, such as the idea of greater external sources of information to create value. However, open innovation explicitly incorporates the business model as the source of both value creation and value capture. This latter role of the business model enables the organization to sustain its position in the industry value chain over time.

At its root, open innovation assumes that useful knowledge is widely distributed, and that even the most capable R&D organisations must identify, connect to, and leverage external knowledge sources as a core process in innovation. Ideas that once germinated only in large companies now may be growing in a variety of settings – from the individual inventor or high tech start up in Silicon Valley, to the research facilities of academic institutions, to spin-offs from large, established firms.

2.2 The Open Innovation Paradigm

The book Open Innovation [1] describes an innovation paradigm shift from a closed to an open model. Based on close observation of a small number of companies, the book documents a number of practices associated with this new paradigm. That book was written for managers of industrial innovation processes, and the work has received significant attention among managers.

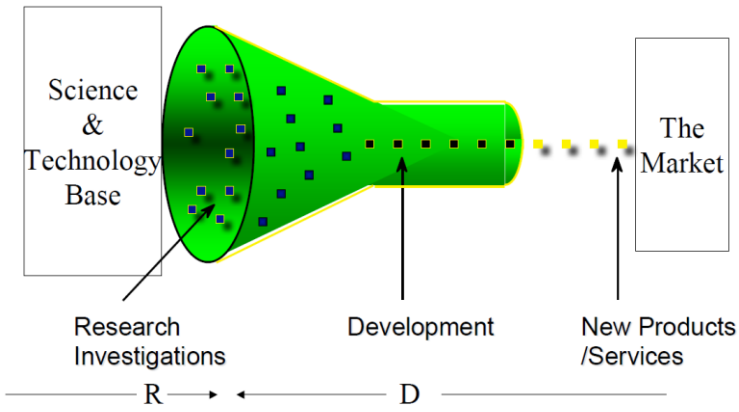

Figure 1.1: The previous paradigm: a closed innovation system (©Henry Chesbrough)

The figure 1.1 shows a representation of the innovation process under the previous Closed model of innovation. Here, research projects are launched from the science and technology base of the firm. They progress through the process, and some of the projects are stopped, while others are selected for further work. A subset of these is chosen to go through to the market. This process is termed a "closed" process because projects can only enter in one way, at the beginning, and can only exist in one way, by going into the market.

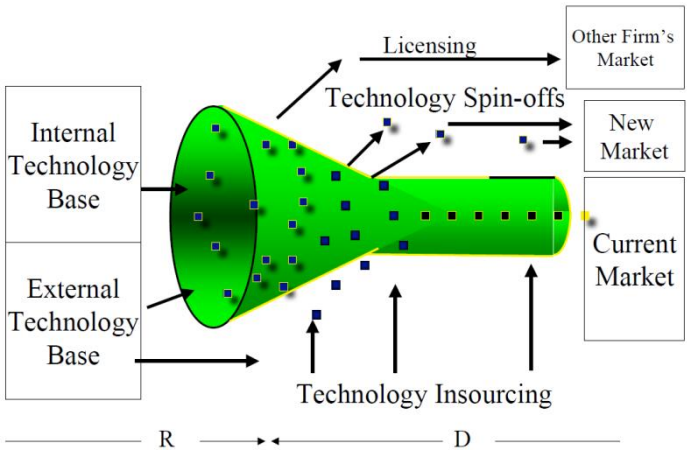

Figure 1.2: The Open Innovation Paradigm (©Henry Chesbrough)

Figure 1.2 shows a representation of an Open Innovation model. Here, projects can be launched from either internal or external technology sources, and new technology can enter into the process at various stages. In addition, projects can go to market in many ways as well, such as through outlicensing or a spin-off venture company, in addition to going to market through the company´s own marketing and sales channels. In this "open" model there are many ways for ideas to flow into the process, and many ways for it to flow out into the market.

There is growing academic and industrial interest in this concept, as well as some research activity that, when taken together, suggests that this may be a fruitful avenue for scholarly inquiry.

2.2.1 The two sides of Openness

The concept of open innovation encompasses both the acquisition (i.e., the "buying") of external knowledge (including the integration of external knowledge sources into the internal knowledge base of a firm) and the external exploitation (i.e., the "selling") of these knowledge assets in different markets. Regarding these two processes, prior research has mostly focused on external knowledge acquisition and the make-or-buy decision, i.e., whether to develop knowledge in-house or to acquire it from external sources.

In the last few years, however, interest in external knowledge exploitation (in terms of "selling" or exchanging knowledge in the market) has also grown significantly. A primary reason for this increased attention to the "sell" side comes from the fact that markets for technological knowledge have developed and firms have more opportunities to leverage their technological assets. External knowledge exploitation includes, for instance, selling of technologies and intellectual property (IP) like patents, licensing-out, and collaborations in order to gain extra revenues. It may further be used to realize strategic benefits, such as establishing own technologies as industry standards. However, since selling of knowledge assets also has negative effects (in particular, the diffusion of competitively relevant knowledge), firms are increasingly faced with a "keep-or sell" decision.

2.2.2 The determinants of Open Innovation

The basic premise of the open innovation model is that by enlarging your "research organization" you may be able to tap into a much larger pool of ideas and find such ideas faster than if you limit yourself to the traditional, closed innovation model.

Furthermore, you may benefit from "dead born" ideas by utilizing them outside the boundaries of your own firm, but within the business models of other firms, where these ideas may unfold their full potential [1]. By contrast, the traditional, closed innovation approach has grown out of a rather understandable desire to keep the value of innovations and ideas to oneself. This is also very much in line with the insights gained from the resource and capabilities view. As Barney [2] has pointed out, value creation within firms depends on these firms' ownership of valuable and rare resources, which are difficult to imitate or substitute (where the latter two issues simply reinforce the "rarity" concept). If rarity is thus a key consideration, it is quite obvious that innovation, or the creation of new combinations, is a primary source of value. By definition, the entrepreneur is the first (and initially the only) person to possess that particular new productive combination and can thus benefit from a monopoly position. Yet, as others imitate what was once a "new" combination, the entrepreneurial firm loses its ability to extract value from the market as the rarity of its resource combination, and hence its monopoly, declines.

The open innovation model, however, contradicts these ideas by suggesting that sharing knowledge and innovating jointly with others, even competitors, is a superior way of generating value. Obviously, however, this "sharing" will reduce the rarity of a given innovation for each of the firms. To the extent that the "old" wisdom discussed above is correct in suggesting that value appropriation has to be based in some way on charging prices that exceed average costs, and that that is only possible if at least some element of rarity exists (i.e., a market structure different from that of perfect competition), there is a need to analyze where this superior value may come from.

This, in turn, will then point to tradeoffs that may determine when an open system of innovation is indeed superior to a closed one and when not.

3 Measuring Open Innovation

3.1 The relevance of measuring

Thanks to loads of compelling research studies and best practice cases in open innovation carried out over the last decade [REFS], several companies nowadays begin to embrace and partially apply the new principles and methods open innovation offers. However, when managing open innovation at the project level, even experienced managers still go blank at the question: how to assess, control, and measure the performance of these activities? this issue will be addressed by discussing a general framework for an open innovation performance measurement system.

Obviously, since innovation by nature is a non-routine, creative and unpredictable task, metrics might seem like something for the controller, rather than a common skill that is central to the innovator. And while many argue that too much measurement stifles innovation, it still remains a key for the survival of every business. Assessing progress and measuring the impact of your innovation activities enables you to change your strategy before mistakes become expensive or great ideas are refused. While the development of innovation metrics in general is still an emerging discipline, there is absolutely no clear guidance on how companies should approach them in order to measure the success of their open innovation initiatives. Anyway, in these times of fast changes, there is actually a good chance that the 'old' systems you set out to measure innovation won't match the challenge you're going to face when piloting the new and emerging trends of open innovation.

Since the last few decades companies such as Procter & Gamble (P&G) and General Electric (GE) have been already innovating with external partners beyond their own boundaries in order to succeed in R&D's ever changing environment and to deliver better quality and more competitive products in a more cost effective manner. Thus, they have undertaken substantial efforts to acquire and use external knowledge from outside actors by collaborating with in technology partnerships, joint ventures or strategic alliances – to name just a few examples of traditional inter-firm co-operations.

However, whereas the existence of such external cooperation networks is not a new world phenomenon, the Internet and in particular the rise of new information and communication technologies (ICT) in fact have substantially broadened the scope and deepened our understanding of open innovation. In this new era of open innovation companies are innovating with external actors in a very flexible and informal way beyond the traditional notion of technology partnerships or innovation alliances [3]. Just as cloud computing provides companies with virtually unlimited storage capacity and processing resources on demand, today new ICT-enabled methods of open innovation such as crowd-sourcing platforms connect companies to the 'human cloud' –a worldwide network of millions of individuals, ready to deliver ideas and solve problems that range from simple to the complex.

Anyway, whereas these new methods of open innovation have become an important part of many companies' innovation strategy, they also imply a fairly high level of complexity and uncertainty that innovation teams, within their exclusively internal or even traditional inter-firm cooperation projects, have been never faced before.

Teamwork will not just be cross functional, but will span across a higher number of companies, universities, governments, suppliers, customers, and individuals. While in the past traditional problem-solving processes led to perhaps a few hundred ideas, these days, a successful ideation contest– if it is directed to an external network– can easily generate thousands of insights from different sources across the globe.

In this new environment of a problem solving process, external idea (?) or solution provider (?) often get access to numerous online tools, such as search engines, databases, source codes, tools for creating wikis, podcasts, websites, CAD programs, and other toolkits [4]. With this equipment they already started to collaboratively develop successful products such as applications for mobile devices or other open source innovations that have the potential to change an entire industry.

The incorporation of such a large number of diverse insights can be challenging, confusing and apparently seems to be uncontrollable. In this context, measuring open innovation would mean that the contribution of each participating individual and their innovation tools needs to be transparently stated in a firm's performance measurement system in order to accordingly evaluate the quantity and quality of their provided inputs.

It is easy to see that the level of complexity of initiatives driven by open innovation far exceeds the one which corporate innovation teams in traditionally executed innovation projects have to deal with. This means, that deploying open innovation requires not only access to financial resources and the clear allocation of responsibilities. The untapped secret lies in a company's ability to successfully measure the huge amount of knowledge– ranging from very general submitted ideas to highly complex technical solution proposals – which might include developing a list of 'approved' indicators for project managers to incorporate into their performance measurement systems.

Studies have shown that around 90% of company's innovation efforts never result in commercialized products or services [5]. The low return on innovation leads to the suspicion, that innovation in practice still seems to rely on fairly random incidents, rather than being the result of clearly defined performance measurement procedures [6]. Other research confirms the suspicion, pointing especially to the shortcomings of coordination and underestimation of the complexity that arises in the context of open innovation processes [7]. It seems, however, that if companies start approaching open innovation in a more organized and systematic way – e.g. through the application of new innovation metrics – they could raise their return on innovation at no or small additional costs.

Historically, organizations have always measured performance– primarily to reduce process costs and improve business effectiveness. Several performance measurement systems are in use today, at which the balanced scorecard (BSC) is one of the most widely applied approaches that takes a holistic view of an organization.

Nowadays, numerous companies employ the BSC or similar tools to control and measure their internal innovation activities. However, only few recognize the need to adapt their measurement tools to the new concepts and challenges of open innovation. Given that open innovation involves innovating with others, makes it for example nearly indispensable to have a certain degree of transparency about the capabilities and characteristics of your innovation partners. The heterogeneity of a network, incentive systems or the design of tools and platforms for cooperation – to name just a few basic success factors – becomes more critical for successful innovation in an open innovation environment.

For this reason appropriate metrics need to be developed that help to quantify these new critical success factors and allow an appropriate evaluation of progress, success as well as strengths, weaknesses or even possible reasons for failure of your open innovation initiatives.

Among those companies that traditionally do measure innovation, most of them still use very generic innovation metrics that are primarily based on R&D and product-development metrics solely (i.e. number of patent filed in the past year or the number of ideas submitted by employees). Though somewhat useful, these metrics provide only little support for organizations on their innovation journey, since they do not map performance measures that instantly drive impact or completely indicate a company's (open) innovation performance.

In line with the quote "you cannot manage what you cannot measure" it is not surprising, that many companies still fail on open innovation and that most of them are disappointed in their return on innovation spending – so do poor measurement practices often result in avoidable project extensions or in far too early cancellations with wasted resources and a lower return on innovation investments.

It does not seem that the commitment to new innovation measurement approaches is missing. What seems to be a real challenge for companies is finding the relevant metrics for their open innovation activities and the discipline making measurement a priority in innovation management as part of a standardized process. Thus, appropriate tools and metrics are needed that empower innovation teams to properly measure open innovation in order to be able to promote the best innovation ideas and solutions and in fact to turn new knowledge into successful commercialized products or services. If companies could raise their return on innovation with just 10-20 % through controlled and measured open innovation practices this would give them a significant competitive advantage and the potential to be true game-changers.

3.2 Framework for an Open Innovation performance measurement system

With their project experiences in performance measurement and the findings of desk-research Ernst&Young [9] singled out three quite distinct principles that companies must consider in order to successfully implement a metrics-based performance measurement system for their open innovation projects.

A simple framework is outlined in figure 2.1, which combines these three principles on open innovation metrics. It provides the perspective for a suite of KPIs and provides a better idea of how to properly set up a performance measurement system that will help companies to assess, control and measure their open innovation activities.

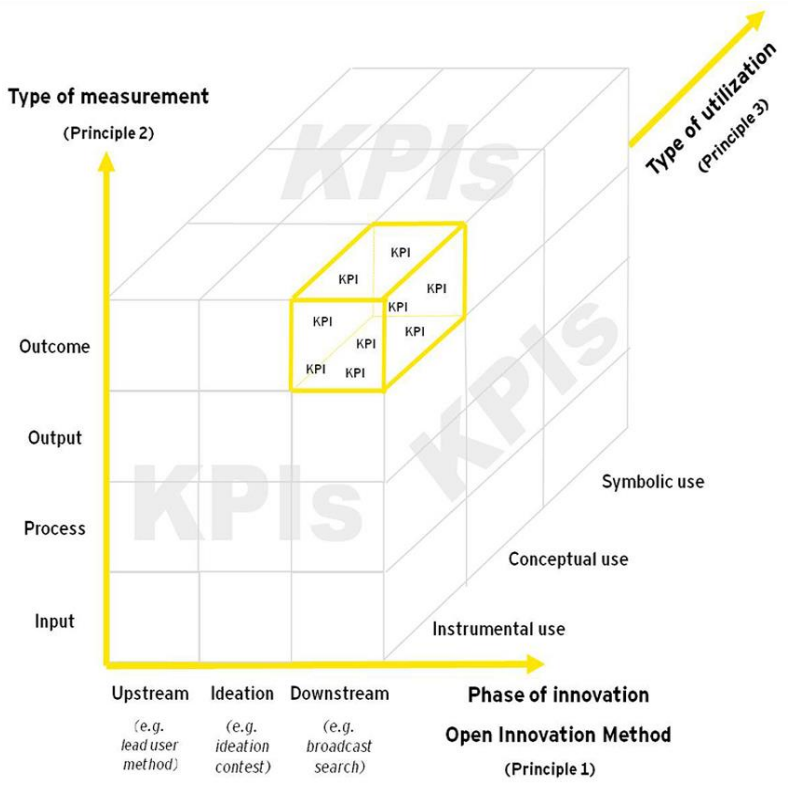

Figure 2.1: Framework for an open Innovation performance measurement system (@ www.innovationmanagement.se)

3.2.1 Principle 1: Use unique metrics for each open innovation method

In order to pilot open innovation at project level, you first have to select a specific open innovation method that suits your desired project goals. Some of the instruments are designed for the active integration of need information that usually occurs primarily in ideas or creative thoughts from external partners at the earlier stages (upstream to ideation) of an innovation. Other instruments focus on solutions provided by innovative outsiders, answering an open call for cooperation and can be used at the later stages (downstream) of the innovation process [3]. This implies that measuring open innovation highly depends on your desired innovation goals and the underlying open innovation method with its fundamental features, characteristics and resources that you are going to use in your open innovation project. In other words, method-specific metrics or KPIs are needed in order to be able to properly assess and measure the progress and success of each of these activities.

The three most prominent methods of open innovation, which cover both the various early as well as the later stages of the innovation process, could be named as follows:

- The lead user method identifies innovative users who are at the leading edge of important trends and benefit greatly from obtaining a solution to their needs. Thus they are motivated to discuss and tackle their innovation needs and ideas in innovation workshops
- In an ideation contest, a firm seeking innovation-related information posts a task-specific challenge to a population of independent, competing agents (e.g. customer, suppliers, etc.)

who then submit ideas within a given timeframe. The firm awards the participants that generated the best solutions

- Broadcast Search involves contests that seek technical solutions rather than just ideas. Online broker companies, so-called intermediaries, such as InnoCentive or Nine Sigma provide firms access to a global pool of scientists, engineers and other professionals to help them solve primarily R&D problems they have been unable to solve through internal methods. The companies submit a problem, with a stipulated time frame and cash prize for the winning solution, and then, with the help of the intermediary, define the problem and develop criteria for picking a solution

It is quite obvious that measuring the innovation success of a lead user project requires a different set of KPIs than those required for broadcast search. Whereas the focus of a lead user project lies primarily on evaluating the identified new needs and trends provided by innovative users, measuring the success of broadcast search requires metrics that map the potential performance of a technical solution.

3.2.2 Principle 2: Consider different types of measures: input, process, output and outcome (IPOO)

The second principle concerns the different types of measures that need to be tracked by a holistic performance measurement system. The framework should be designed to link the outputs or outcomes of an open innovation initiative to the inputs.

- Input KPIs measure the input elements within a project, such as human or financial resources
- Process KPIs are used to transform inputs into outputs and to improve the efficiency of the innovation process: time variances, budget variances, error ratio, etc.
- Output KPIs measure the results of the development activities within an innovation process: number of ideas, number of patents, number of publications, etc.
- Outcome KPIs aim to determine the value of an innovation in terms of economic and market-oriented performance indicators

Only the combination of both input and output (outcome) metrics can provide a meaningful understanding of the cause-effect relationships of a project. For this reason, it is better to constitute a frame that allows return on investment considerations, i.e. relating the input to the output (outcome) of a broadcast search project, with significant measures for efficiency.

Moreover, since the real value of the output (outcome) of an open innovation initiative is the result of more than just the resources invested (input), various measures of the processing or transformation procedures should be also integrated into the framework.

3.2.3 Principle 3: Think about how to effectively utilize open innovation metrics

The mere provision of a performance measurement system through the collection of appropriate management information, per-se is no guarantee for successful innovations. The collected KPIs must be initiated by the responsible actors within a company.

Pelz [8] proposes that metrics can be utilized on three different levels: instrumental, conceptual and symbolic:

- Instrumental use refers to the application of information/metrics used directly for decision making. For instance, when the open innovation 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/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 open innovation projects is on average 30 % lower than for conventionally-run innovation projects, he is using the metric "lead time" conceptually

- Metrics can also be used after decisions have already been taken to legitimize and justify them. This kind of use is called symbolic. In case an open innovation project is cancelled due to cost overruns, the official reason for its termination is "quality of ideas" – this metric is used symbolically

The way how metrics should be utilized highly depends on the desired project goals. For instance, if following rather long-term goals than short-term success with an open innovation project, i.e. to facilitate a sustainable innovation culture, hard measures such as "expected sales" should be used conceptually for providing general enlightenment and understanding, and less for decision making purposes.

4 Regional influence on innovation

The new paradigm created by open innovation enables a higher communication between companies. Different businesses understand that in order to innovate, collaboration with external companies is essential, regardless of the knowledge area they belong to.

4.1 Regional Innovation Systems (RIS)

Regional innovation systems can be defined as a set of interacting private and public interests, formal institutions, and other organisations that function according to organisational and institutional arrangements and relationships conducive to the generation, use, and dissemination of knowledge [10]. The importance of this concept of innovation system relies on the creation of a framework of the understanding of the innovation process in regional economies.

According to Hajek and his colleagues [ibid], European union's policy to integrate regions that are falling behind and the level of entrepreneurship and innovation activities in knowledge intensive regions caused economic growth during the 2003-2009 period. This affirmation, confirms that regions and regional policies (promoted by European policies) have an economic influence on the regions that are applied. The second part of the affirmation refers to knowledge intensive regions; places where more traditional companies, universities and research centres coexist create an environment where innovation is promoted. Moreover, if technology profiles are close, knowledge spillovers will be more frequent within innovation systems, fostering knowledge transfer and thus creating more opportunities for innovation.

Related to the previous work Cooke [11] argues that in knowledge based industry, generation and commercialisation of research driven knowledge takes place in research institutes, consultancies and small sized but regionally agglomerated firms rather than in the corporate sector. This argument puts more emphasis on the regional influence on innovation and the competitive advantage that regionally agglomerated firms are able to obtain participating in locally joined systems.

Innovation processes and policies cannot be understood without understanding or mentioning interactions between local or regional, national and global actors and institutions. Different regions promote different research topics depending on their model for region development; therefore, it is more probable that a cluster with influence on an area will be prone to receiving more funding than an isolated company. As Mayer [12] confirmed, "as locational policies are relying on the identification, the development and the promotion of place-specific assets, they are the result of place-bound and path-dependent interplay of a region's specific economic sector-mix and its political-institutional setting".

In order for a RIS to be successful, it should possess most of the value adding processes of a sector in addition to some diversification capabilities that will facilitate the connection with other sectors, combining both deep knowledge in specific fields and openness to new fields.

According to Cooke [11], RISs contribute to a transformation in the nature of organisations. The actual trend is to interact and share rather than keeping knowledge as a secret asset. Cooke refers to this change as the evolution from "Globalisation 1" to "Globalisation 2".

In the case of the CLINES project, involved clusters represent the deep knowledge in the previous statements. As can be demonstrated in the deliverable D4.3 Final Joint Action Plan, CLINES partners have understood the possibilities of creating stronger RISs and their proposed actions orbit around communication and alliance creation, with other companies and institutions, as they are the base for a strong presence in regional research programs and gain competence in their respective markets.

Within CLINES some thorough work has been conducted in order to identify and analyse which are the main research and innovation focus from the public bodies of the participating regions. The outcome of this work was reflected in Deliverable 2.5 Regional Match-Analysis, and we will include a brief summary in the following subsections so as to relate our proposed Open Innovation principles with the specificities of each region.

4.1.1 Bavaria

Priorities regarding to business strategies for a cluster action plan:

- Smart City products should be people-oriented and require a customized marketing strategy.
- Future business within the Smart city domain will be generated on global market.
- Interoperability of Smart City products is necessary for exporting of the services.

Priorities regarding to public policies for a cluster action plan:

- Legal frameworks to develop local sustainable solutions are needed that offer the best opportunities to develop local sustainable solutions.
- Cross-departmental interaction between different verticals: energy, transport and health should be promoted.
- Structured inter-cluster cooperation is needed to look at smart products as part of a more integrated approach.

The Bavarian research, technology and innovation policy in coming years focus in particular on the following current application and technology fields: [1]

- Life Sciences (Life Sciences, especially biotechnology and systems biology)
- Information and communication technologies
- Efficient production technologies, mechatronics, automation, robotics
- New materials, smart materials, nano and micro technology
- Clean Tech - resource-saving energy, transport and Environment-technologies, Renewable resources (including biofuels), electric mobility
  Innovative, technology-based services

Priorities regarding to public research strategies:

[1] Overall concept for the Research, Technology and innovation policy the Bavarian state Government 2011

- Fragmented research in individual disciplines
- Sustainable development of interdisciplinary research fields

4.1.2 Flanders

To realize a sustainable growth and to create jobs, the Flemish government is applying 'Smart Specialisation (S3)' as a Regional Innovation Strategy. This S3 for Flanders has to create the environment for leading innovation actors and clusters to create value and which allows them to become more competitive. This Flemish S3 goes beyond borders as it has a cross-regional and international scope. Although there is room for other initiatives the Flemish government suggested some domains to focus on:

- Sustainable chemistry;
- Specialized 'make' industry;
- Personalized healthcare
- Specialized logistics
- Specialized agro-food
- Integrated construction, environment and energy;
- Smart systems;
- Creative industries and services

With this S3 the Flemish government is fighting against the **'fragmentation'** of the Flemish innovation landscape with several bottom up innovation initiatives. It addresses the lack of alignment between a mostly mature industry with limited investment in innovation and the academic world which wants to internationally excel in different domains.

The Flemish S3 suggests a solution to this fragmentation. Through the development of **roadmaps** addressing broad societal challenges the Flemish government promotes alignment between strategies of different innovation actors on regional and European level. Specialization always involves expertise from different domains (**cross specialization**).

A smart specialization strategy focused on transformation of the economy and societal transition can take different **formats**:

- Innovating existing value chains with new technology
- Transition from existing to new value chains
- New 'branches' of existing value chains through diversification
- Radical new value chains enabled by technology breakthroughs

Smart specialization requires '**leadership'**. Entrepreneurial innovation actors who drives the discovery of new/modified/enhanced value chains forward. Hereby leveraging on the capability and capacity of a rich Flemish innovation ecosystem. This discovery process is built on the assumption that the innovation actors have the **'strategic capacity'** to position themselves internationally, to align and create alliances, to build leadership based on vision, strategy and action.

Convergence to cross specialization can be promoted through **'shared strategic intelligence'** related to e.g. strengths, weaknesses opportunities, threads, mapping of opportunities with technological capabilities and strengths, best practices, cases, learning processes, etc.

4.1.3 Basque Country

Solid business cases are key for sustainable smart city solutions. A cluster action plan has to focus on creating the most optimal conditions for smart city solutions to flourish: smart mobility, smart environment, smart people, etc.

The Basque Government has defined three smart specialisation criteria related to advanced manufacturing, energy and biosciences (where human health is at the core of the activity). In addition, a series of niches have been identified, with different level of maturity related to territory. This is also related to the Basque country companies' business strategies, because the companies are focusing their business in these areas:

- Energy:
  - Generation
  - Transport and distribution
  - Power electronics and capital assets
- Territory:
  - Leisure, entertainment and culture
  - Urban planning and regeneration
  - Ecosystems
- Biosciences:
  - Health
  - Agrifood sector
- Advanced manufacturing:
  - Transport
  - Metal
  - Capital assets
  - Intelligence, materials, equipment...

There is a series of needs that companies in the IECT sector have to face, such as:

- Need to collaborate with other sectors, such as the tool-machine sector.
- Need for training and to create new knowledge to provide machines with intelligence.
- Development of new business models focused on providing services related to the smart factory concept.

4.1.4 North Denmark

There is a large potential for North Denmark business in the globally growing market for Smart City solutions, especially within wireless communication. However, within the North Denmark Region an overall strategy within the ICT area as well as a more concerted effort in general is still lacking.

The five lighthouse projects are;

Name:	**Description:**	**Smart City domain:**
Open Data Lab	The creation of an open big data platform	Smart Mobility / Smart Living
Digital infrastructure to citizens and companies	The dissemination of well-developed and comprehensive of broadband, fibre-optic broadband, and mobile Internet	Smart Mobility
Smart City 9220 (Aalborg East)	A Horizon 2020 urban renewal project	Smart Mobility / Smart Environment
Industrial symbiosis	The establishment of projects about resource efficiency by utilizing waste or energy surplus	Smart Environment
Green Agents	Supporting more sustainable and green citizens with "Green Agents" as main supporters as well as the development of Apps to support this	Smart Environment / Smart Living

4.2 Regional capabilities impact on innovation

Companies are usually shaped by their context. This is a general and well known statement that may not be correct nowadays. Dahl and Rodriguez [13] found that regional capabilities, especially knowledge resources, influence firms only to some extent and differ across regional contexts. In their words, "regional R&D investments are associate with stronger effects of regional and national collaboration in terms of impact on radical product innovation" while education level is connected with a higher international collaboration leaving apart local or national collaboration on product innovation. The following figures illustrate their findings:

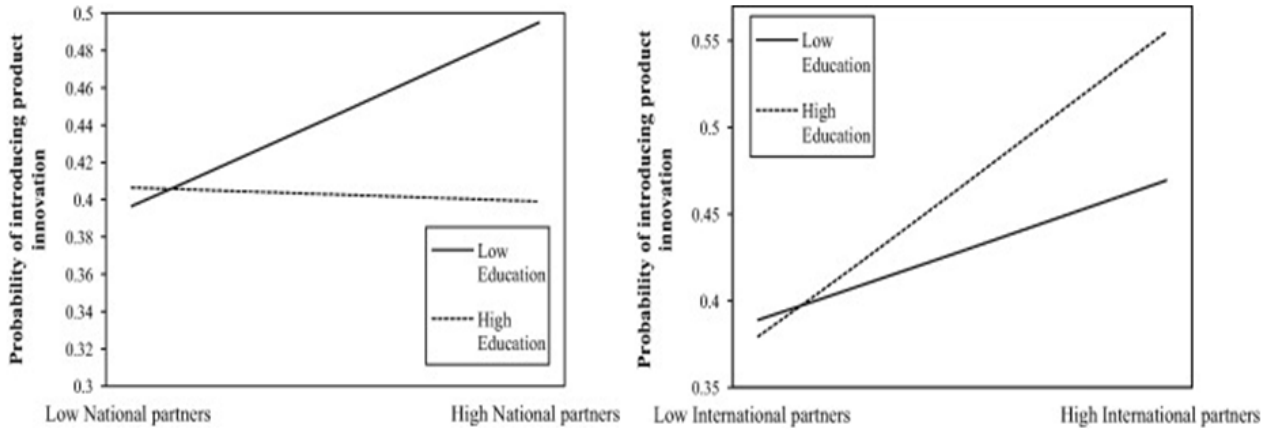

Figure 3.1: Probability of introducing product innovation through cooperation with national (left) and international (right) partners in regions with a high and low endowment of human capital (Dahl and Rodriguez, 2015).

Even if regional capabilities are of important, Dahl and Rodriguez [ibid] demonstrated that communication with international firms was essential for Norwegian companies in order to increase their potential for both incremental and radical innovations. Their explanation for the case of Norway is that their research and development intensity is relatively low while their knowledge absorptive capacity is high; therefore Norwegian companies are better transforming ideas than creating knowledge.

In a similar way, Lau and Lo [14] determine that external inputs can boost a company's innovation performance. Even though they do not emphasize the origin of the external input, they confirm that value chain information sources are the greatest source of innovation for companies in Hong Kong. Opposed to Norwegian companies, businesses in Hong Kong collaborate with a mixture of local providers and overseas customers allowing them to acquire new technologies in different ways for both cases. In the case of overseas stakeholders, technologies are usually acquired via OEM and ODM businesses while in the case of local suppliers reverse engineering techniques are more common. Furthermore, Lau and Lo [ibid] also point differences between the acquisition, assimilation, transformation and exploitation of new technologies and knowledge. They conclude that regional innovation initiatives (RII) affect transformation, information sources influence acquisition and assimilation while knowledge intensive business services (KIBS) shape assimilation.

From this section of the deliverable, an important conclusion is obtained. Companies should have a picture of the different capabilities around them and adapt their innovation policies and attempt to find the opportunity that can offer the greatest benefit. As important as regional capabilities are internal capabilities; thus, being aware of internal processes and capacities and taking them into consideration is of paramount importance for companies to define an innovation strategy. As seen for the cases of Norwegian and Hong Kongese companies, different environments require different innovation approaches in order to be successful and trying to define a common framework for the majority of the cases would not be sensitive.

5 Regional Open Innovation Guidelines

This section is aimed to define the relation between the general principles of the Open Innovation paradigm and the Regional approach in order to define an Open Innovation Methodology that could be deployed within the CLINES participating regions.

The goal is to identify which are the key guidelines to be followed within each of the Regions in order to propose and generate innovative projects and products, which are aligned both with the Regional policies/research focus and with the Open Innovation approach.

- Openness and collaboration. In both Open innovation and RIS paradigms, openness is a fundamental feature. As seen in sections 2.1 and 2.2, external innovation sources and paths to market are as important as internals and RISs policies react to strong clusters; these clusters are promoted and will grow stronger if openness and collaboration are the common framework

- Commercial value creation. Business models should focus on creating commercial value from research and development. If the first point of openness and collaboration is fulfilled companies knowledge networks grow exponentially and the challenge for companies is how to transform that knowledge into marketable products. There is not only one guideline to follow for value creation and every case may potentially be different

- Knowledge and technology outflow. After creating commercial value, companies should exploit it. Sometimes this exploitation can be internal but in some others, external exploitation may be more suitable

- IP management. Along with knowledge and technology outflow, intellectual property management is a key feature on the open innovation paradigm. If different organisations collaboration is a source of knowledge and marketability possibilities, keeping rights over the created value is core for obtaining a monetary income from research activities

- Measuring or assessing innovation performance. As explained in section 3, assessing and measuring the impact of innovation activities offers a perspective on the performance and how suitable is a company's strategy. Therefore, an appropriate measure system is useful to improve the whole company performance

Once the main Innovation principles are stated, and the regional public trends are established and identified, we need to develop some strategy to relate our regional JAP actions with the former. This way an overall strategic plan can be defined, where:

- a Regional Innovation Strategy (RIS) is revealed and translated into research and business focus trends

- an Open Innovation methodology is applied according to some set of principles that proposals, projects and innovation actions should follow and could then be measured

- a set of specific actions derived from the JAP is aligned with both the RIS and the Innovation methodology in order to join together all efforts towards a common direction

The following subsections will look over the regional highlighted actions collected within deliverable D4.3 Final Joint Action Plan, with the objective to relate them to each RIS and Innovation principle.

5.1 Bavaria

Regional Guideline	**JAP action**	**Open innovation guideline**	**Proposed measure**
Future business within the Smart city domain will be generated on global market.	Action 6: Establish a CLINES office to organise joint actions	Openness and collaboration	Funding for formal CLINES cluster office
	Action 13: Reach for international collaboration	Openness and collaboration	Number of cross-cluster contacts
	Action 11: Build knowledge of business models	Commercial value creation	Number of business models developed for Smart City use cases
Smart City products should be people-oriented and require a customized marketing strategy.	Action 4: Communicate ESSC vision through show cases and convincing stories	Knowledge and technology outflow	Number of Municipal customers reached with SmartCity vision communication
	Action 10: Understand users and value-creating cases	Knowledge and technology outflow	Number of usage scenarios validated
Interoperability of Smart City products is necessary for exporting of the services.	Action 12: Identify key industrial partners and establish matchmaking	Commercial value creation	Value chain is described; Coverage of value chain in matchmaking
Cross-departmental interaction between different verticals: energy, transport and health should be promoted.	Action 2: Mediate across business sectors, public agencies, alliances, and initiatives related to Smart City and urban development	Openness and collaboration	Diversity of domains in reference projects

Fragmented research in individual disciplines	Action 9: Liaise between business and research groups	Openness and collaboration	Number of Research institutions that sharpened their research profile according to the region's smart specialisation

5.2 Flanders

Regional Guideline	**JAP action**	**Open innovation guideline**	**Proposed measure**
Smart Specialization in the domain of smart systems	Action1: Create a common vision Action 5: Joint events and actions	Openness and collaboration	Nb. Of organization supporting the Clines vision document
Overcome the fragmentation of the Flemish innovation landscape	Action1: Create a common vision Action 3: Establish a permanent smart city round table Action 4: communicate vision Action 5: Joint events and actions	Openness and collaboration	Nb. Of stakeholders involved in CLINES activities Nb. Of disciplines, sectors, regions, nationalities involved in CLINES activities
Develop cross specialization roadmaps to align innovation actors	Action 5: Joint events and actions Action 8: Innovation workshops and demonstrators	Openness and collaboration	Nb. Of joint roadmaps, actions plans. Nb. Of joint deliverables
Focus on value chains to transform economy and society	Action1: Create a common vision Action 5: Joint events and actions Action 8: Innovation workshops and demonstrators	Openness and collaboration Commercial value creation Knowledge and technology outflow	Nb. Of new projects focusing on innovating value chains. Nb. Of cross disciplinary teams working on innovating value chains
Develop strategic capacity and leadership	Action1: Create a common vision Action 3: Establish a permanent smart city round table Action 4: communicate vision	Openness and collaboration	Nb. Of people committing to drive new value chains forward. Nb. Of people supporting the development of new

	Action 5: Joint events and actions		valueh chains. Nb. Of new instruments supporting the development of cross specialization initiatives
Build shared strategic intelligence	Action 5: Joint events and actions Action 11: Build knowledge of business models Action 14: Exchange knowledge of public anc commercial investment	Openness and collaboration Commercial value creation Knowledge and technology outflow	Nb. Of strategy papers. Nb. Of publications Nb. Of new business models Nb. Of people attending workshops and trainings.

5.3 Basque Country

The following chart intends to relate the main actions identified in the final JAP to be deployed as part of the regional cluster strategy, with the rest of core axis presented within this report: the key regional policies and the open innovation methodology.

Regional Guideline	**JAP action**	**Open innovation guideline**	**Proposed measure**
Need to collaborate with other sectors	Action 3: Stablish a permanent smart city roundtable	Openness and collaboration	Number of collaborative actions/initiatives derived from smart city roundtable
	Action 12: identify key industrial partners	Openness and collaboration	Number of new business relations established among key industrial companies
Need for training and to create new knowledge	Action 13: reach for international collaboration	Openness and collaboration Knowledge and technology outflow	Number of external collaborations achieved Quantify the value of each external relation: number of common projects/proposals/actions

			Quantify external exploitation of assets through international links
Development of new business models focused on providing services related to the smart factory concept	Action 5: create joint events and specific actions	Openness and collaboration Knowledge and technology outflow IP management	Quality performance of new business models created Number of cross-initiatives among sectors: smart factory – smart product – smart city Patents, concessions and partnerships numbers
	Action 8: Facilitate innovation workshops and demonstrators	Openness and collaboration Knowledge and technology outflow	Number of actions intended to bring innovation near small companies or in a daily basis

The table above represents how a regional guideline will be attended by JAP actions for the Basque Country as well as the link between the specific action in the JAP and open innovation guidelines explained in this section. As an example, the need to collaborate with other sectors will be faced creating a smart city roundtable and identifying key industrial partners but these two actions fulfil only one open innovation guideline which is openness and collaboration. Finally, proposed KPIs will be used as a measure for assessing the performance of the different actions. These KPIs should be aligned to the objectives for each action in order to offer practical information.

5.4 North Denmark

The regional strategy for development 2015-2018 includes the areas smart-transportation and smart-energy – especially the potentials of Intelligent Transport Systems and Intelligent Energy Systems are mentioned. Furthermore, the support of these areas via international cluster collaboration is highlighted. Also, the need for further strengthening of open and cross-cutting innovation is stressed together with the needs for globalisation and collaboration in the innovation activities. Finally, the possibility of continually upgrading of employee competences is very important. These overall strategies are reflected in the table below:

Regional Guideline	JAP action	Open innovation guideline	Proposed measure
Need to collaborate across sectors in the innovation process	Action 2: Mediate across business sectors, public agencies, alliances, and initiatives related to Smart City and urban development	Openness and collaboration	Diversity of domains in identified projects
	Action 12: identify key industrial partners	Openness and collaboration	Number of new business relations established among key industrial companies
	Action 8: Facilitate innovation workshops and demonstrators	Openness and collaboration Knowledge and technology outflow	Number of actions intended to bring innovation near small companies or in a daily basis Number of cross-initiatives among sectors: smart transport – smart energy
Upgrading of employee competences	Action 13: reach for international collaboration	Openness and collaboration	Number of external collaborations achieved
	Action 9: Liaise between business and research groups	Knowledge and technology outflow	Number of projects and knowledge transfer links established
	Action 4: Communicate ESSC vision through show cases and convincing stories	Knowledge and technology outflow	Number of projects and knowledge transfer links established
Future business within the Smart city domain will be generated on global market.	Action 13: Reach for international collaboration	Openness and collaboration	Number of cross-cluster contacts

6 Conclusions

This deliverable aims at linking regional guidelines defined as polices for each regional innovation system with the actions proposed for each region partners in their respective Joint Action Plan. As explained in the document, RIS focus on open innovation techniques in order to deploy a region's innovation strategy; therefore, companies should attach to some open innovation principles that will allow them have a better positioning within their region.

Open innovation paradigm is not new as a concept but its acceptance and use by companies competing in similar markets is not a common rule. RIS policies, as described in section 4, attempt to break this mainstream promoting collaboration and knowledge sharing among regional companies and institutions.

As demonstrated in this deliverable and linked to the whole CLINES project, companies can follow a reflexion process in order to understand and adapt their policies to the methods that regions propose for their development. In the particular case of CLINES project clusters, most of the identified actions revolve around openness and collaboration. Attending to this fact it can be concluded that the clusters present in this project are turning towards an open innovation paradigm. The second open innovation guideline in the scope of companies is "Knowledge and technology outflow" which is a basis for collaboration and opening markets as well as a tactic to receive some technological inputs in "exchange" as the result of new relations.

It is worth to mention that measuring the impact of the actions taken is of paramount importance. Measure systems should offer a clear perspective of the performance of the company for its different policies and should be updated in order to adapt to the changes in the regional innovation environment.