Exploring the Quadruple Helix

Report of Quadruple Helix Research
For the CLIQ Project

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CLiQ
CREATING LOCAL INNOVATION THROUGH A QUADRUPLE HELIX

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Contents

Executive Summary

The EU INTERREG IVC CLIQ project commissioned this research into the Quadruple Helix innovation concept.

The overall long-term aim of the CLIQ project is to optimise the benefits of globalisation and innovation to SMEs and entrepreneurs in medium-sized towns. The main objective is to strengthen Local Authority policy and their capacity to support innovation more effectively,

CLIQ has 16 partners from 10 countries, all representing or based in medium sized cities. The partnership includes 9 local and regional authorities as well as representatives of other innovation stakeholders such as Chambers of Commerce, Research institutes and Incubators, to reflect the different roles, competencies and perspectives within a Quadruple Helix concept of innovation.

The task of this research has been to explore and further define the Quadruple Helix concept in innovation and to explore the roles of various stakeholders within it with a particular focus on local-regional government.

Quadruple Helix (QH), with its emphasis on broad cooperation in innovation, represents a shift towards systemic, open and user-centric innovation policy. An era of linear, top-down, expert driven development, production and services is giving way to different forms and levels of co-production with consumers, customers and citizens. This is also challenging the public authorities and the production of public services.

With this, the QH debate connects directly to the Europe 2020 Strategy for smart, sustainable and inclusive growth, and thus to the shifts towards a better connection between stakeholders and a smarter use of resources.

With all these good intensions notwithstanding, Quadruple Helix (QH) is not a very well established and widely used concept in innovation research and in innovation policy. Some conceptions are very close to the Triple Helix (TH) concept, some of them deviate more radically from it, and many of them are somewhere between these two extremes. What is common to all QH innovation conceptions is that they all have included some fourth group of innovation actors into the TH model. There are different candidates what and who this fourth group is ranging from intermediate innovation enablers to different perceptions on user involvement.

All this conceptual and practical elusiveness of QH has posed a set of challenges, for the research to negotiate. Searching under a header "Quadruple Helix", not much appears concerning innovation, especially in terms of good practices. Looking for various interpretations of user involvement in innovation turns up a richer, albeit a mixed catch.

"User-driven" innovation approaches are seen as an essential element in the new broad–based innovation policy approaches, of which the Quadruple Helix is a part. We find the concept user *driven* problematic in the sense that it suggests a bigger role to the user than what there actually exists. Following suggestions coming from the innovation debate, we prefer to use the concepts user-*centred* or user-*oriented*, interchangeably.

So our choice as the fourth helix has been a broadly understood user, and a user-centred/oriented innovation concept. Choosing user as the fourth helix of QH in our research can also be justified by

the long-term practical aims of the CLIQ project, which include optimising the benefits of globalisation and innovation to SMEs and entrepreneurs in medium-sized towns.

This choice has then advised our search for good practice, or to be more precise, good examples of Quadruple Helix. The main criteria for case selection in this report was that the case clearly differentiates itself from Triple-Helix innovation activity, and that it represents QH type of innovation activities, in which all four QH actor groups are involved and in which the users have had an essential role. Also an important criterion was that there exists in-depth and rich enough description of the case. The material included in the report is intended the be the first overview and for initial benchlearning, with reference to further exploration, depending on interest and relevance.

The report was also advised by a Questionnaire and a Case Reader sent to all CLIQ partners. Both produced valuable inputs from the partners to the report.

As a research result we consider Quadruple Helix not as one model, but rather as a continuum or space than a single entity. In the research results we identified and constructed four basic QH-models: (1) Triple Helix + users, (2) Firm-centred Living Lab model, (3) Public sector –centred Living Lab model and (4) Citizen-centred QH models. Each ideal model has its particular goals and types of innovation they produce, a key initiator and varying roles for stakeholders, including public authorities. In the report we have identified experiences, practices, constraints and public authority roles related to these models.

We don't believe that a linear developmental model of first building and securing a Triple Helix model and then moving, in a linear fashion to more and more radical departures from it, is called for. Rather, the reality in the various contexts probably is, that there is a mixture of all these models - some further than others, some in an incipient stage, some more mature - existing or available for the regions. This is apparent also among the CLIQ partners. Likewise, the existing structures and prevailing practices and skills in the region provide different opportunities to address this hybrid and non-linear situation. We recommend, with an important role for local and regional authorities as coordinators, to make a careful analysis of the situation and the opportunities in relation to the "QH space" and the four models we have identified, and to continue building of good learning spaces for connecting stakeholders into innovation.

1. Introduction

1.1. The innovation debate

Quadruple Helix - in itself yet a rather elusive concept - reflects in many ways several features common to the new thinking in innovation process and innovation policy.

Innovation policies have recently been confronted by a multitude of pressures to change. Some of these originate from external developments, some from internal policy issues. National responses to the challenges include both structural and behavioural renewals in innovation policies. The reforms have also their local and regional consequences. An overall development trend is that the dominant innovation policy model, based on linear view and focusing on science push/supply-driven high-tech policy, is enhanced and complemented by a new broader approach than before. Some have called this new emergent approach as broad-based innovation policy (see Edquist et al. 2009, Viljamaa et al. 2009).

The broad-based approach means that also non-technological innovations, such as service innovations and creative sectors are becoming more attractive as innovation policy targets. In addition the notion of innovation is no more restricted to activities carried out by businesses. Broad-based innovation policy can be extended to encompass wider societal benefits and measures targeted to support service innovation in the public service production. One thing which also broadens the innovation policy activities is the shift of focus from the specialization and narrow spearheads of innovation to a variety of decentralised, horizontal and functional measures supporting innovation activities on a broader base and more comprehensively.

This new innovation policy approach includes also a general shift from planning-oriented policies focusing on innovation inputs towards a more flexible, enterprise-oriented policies focusing on market developments. This has meant a transition from policy models looking for general 'best practices' towards more customised policies and policies supporting the development of in-house competencies, both in private enterprises and public organisations.

New broader innovation approach also takes into consideration the fact that both demand and supply side factors influence the way innovations emerge and diffuse on the markets and within the wider society. The need for user-oriented innovation in addition to demand-oriented is recognized. The users and user communities are seen increasingly important for business success and development for commercially successful innovations. User-oriented innovation perspective is considered important also in the public sector where it is believed to support the renewal of public services.

A shift from a relatively narrow and supply-oriented innovation policy to a more broad-based one is a tremendous change in many respects. It necessitates, for example, a development and implementation of totally new policy instruments. It is also very likely, that the roles of different authorities supporting innovation activities (incl. local and regional authorities) have to be rethought. There seems to still be a bias towards support for technological innovation, and policies and measures for supporting "user-driven" innovation are only in their infancy. So far there are only a few examples of how to integrate users systematically in the innovation processes by means of innovation policies. There is also not yet enough approved and researched knowledge about the

procedures and instruments suitable for the public authorities in supporting broad-based innovation activities in international, national and local level.

1.2. Structure of the report

After the introduction and research questions, in the first main chapter 3, Quadruple Helix (QH) is explored in the context of innovation research, where a shift from linear to systemic, open and user-centric innovation models, and the position of QH in this is identified. The concept of user-oriented approaches and the concept of user is explored and elaborated as a basis for the research and also for the search of good practices in QH.

Secondly, on the basis of a screening of QH cases, a set of examples and learning points are presented. The examples are intended to be "benchlearning" material with references for further study. Third, the main results of the Questionnaire and the Case Reader comments of the CLIQ partners are given.

In the chapter on Results, four ideal types of Quadruple Helix are defined according to the goals, types of innovation produced and the roles of the stakeholders. Next, in Conclusions, a definition of Quadruple Helix and an assessment of the relevance and usefulness of the model(s) are given together with conclusions on the roles of public authorities. Finally, in Recommendations, suggestions and guidelines are given with local and regional authorities in mind vis-à-vis the four QH models.

Chapter 1, Introduction, initially locates Quadruple Helix in the innovation debate.

Chapter 2, Research questions and methods, spells out the objectives, points of departure and the approach of the research.

Chapter 3, Quadruple Helix in the context of innovation research, explores the concept of Quadruple Helix from a theoretical point of view.

Chapter 4, Good Practice in QH cases, gives an overview of selected cases illuminating various practical approaches and learning lessons from implementing QH type of innovation.

Chapter 5, Inputs of CLIQ partners, gives a summary of CLIQ partner responses to a survey on user-centred innovation and a request to reflect on a set of examples of QH-practice.

Chapter 6 summarises the research results concerning the QH model and its implementation. In this chapter the roles of public authorities (incl. local ones) are also considered.

Chapter 7 is a summary of conclusions concerning the definition and essential characteristics of QH, the relevance of QH and the roles and possibilities of public authorities in promoting QH type of innovation.

Chapter 8 gives recommendations for regional and local authorities for further investigation and promotion on QH type of innovation.

2.1. The research task: Objective of the CLIQ Quadruple Helix research

The overall long-term aim of the CLIQ project is to optimise the benefits of globalisation and innovation to SMEs and entrepreneurs in medium-sized towns. The main objective is to strengthen Local Authority policy and their capacity to support innovation more effectively, exploring the possibilities of a Quadruple Helix innovation approach in establishing this.[1]

The overall aim of the research is to explore and further define the Quadruple Helix concept in innovation and explore the roles of various stakeholders within it with a particular focus on local government. The results feed into CLIQ interregional learning and underpin exchange, shared understanding and local policy development. The target audience for the research is local authorities and innovation service providers in the European Union.

The research themes were the following:

1) Exploring and defining the Quadruple Helix concept
2) Exploring the role of Civil Society in Quadruple Helix in connecting companies (particularly SMEs), civil society and innovation
3) Identifying good practices in implementing Quadruple Helix
4) Identifying roles and good practices for local authorities in promoting Quadruple Helix.

2.2. Methodology

In our practical methodology, the research questions are interpreted to fall under two main research strands (see Figure 1):

(1) Exploring and defining the concept and model of QH
(2) Identifying good practice in QH

In concluding the research, these categories have fed into each other, i.e. discoveries in the conceptual research have advised empirical findings, and vice versa.

The research has been conducted via five main elements:

(1) The first phase of the research was the exploration and definition phase by conducting a secondary analysis of the research literature concerning QH type of innovation. First, a search of QH-related literature was made in two academic archives (EBSCO and Science Direct) as well as in Google. The following search terms were used: Quadruple Helix, user innovation, user-driven innovation, customer-driven innovation, public sector innovation, client driven innovation; user-centric innovation, customer-centric innovation, client centric innovation; public private partnership; service innovation, public service and innovation; local government and innovation, citizen and innovation, civil society and innovation, user involvement and innovation, public renewal and user involvement. The most important finding of this phase was that the concepts of user innovation and Living lab were very closely related to QH concept as to the criteria of four cooperative innovation actors and user involvement.

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[1] In the following we will use the abbreviation QH for Quadruple Helix and TH for Triple Helix

(2) On the basis of both conceptual and empirical basic studies, a critical screening for analysis of practices on QH cases was conducted. The selection criteria for the good QH cases have been, first and foremost, that the case clearly differentiates itself from Triple-Helix-type of innovation activity, it represents QH type of innovation activities, in which all four QH actor groups are involved and/or innovation activities, in which the users have had an essential role, and secondly, that there is an in-depth and rich enough description available from the case and this description entails experience based real knowledge of the case.

(3) A survey on QH was conducted among CLIQ partners, with a special emphasis on identifying levels of user involvement in innovation in the local-regional partner contexts.

(4) From the case analysis of QH, a set of examples illustrating different applications and learning lessons concerning QH were chosen for reflective comments by CLIQ partners.

(5) Finally, the literature and case analysis, and the responses by the CLIQ partners to the survey and the case examples were the basis of drawing up an analysis of the QH model, conclusions and recommendations.

Figure 1. The research methodology
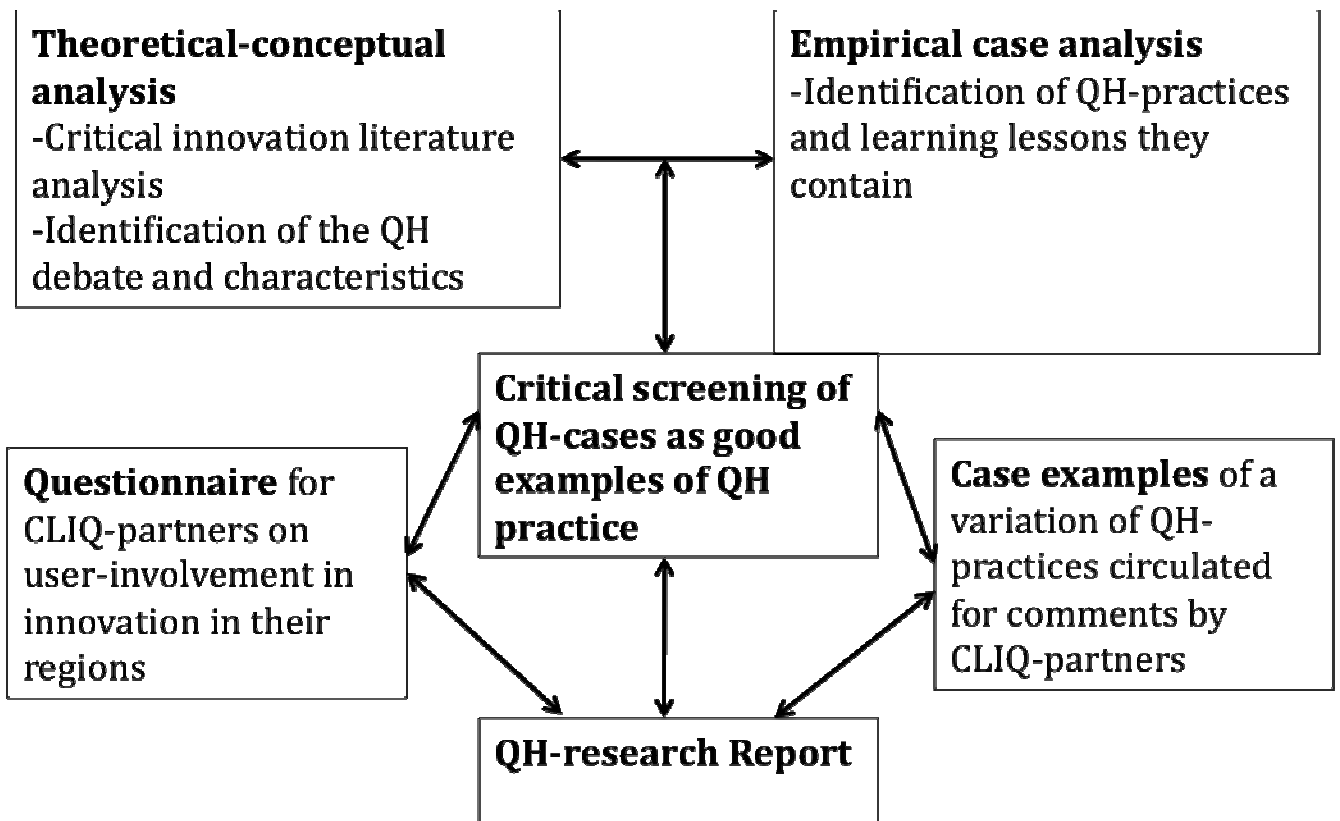
3. Quadruple Helix in the context of innovation research: From linear to systemic, open and user-centric innovation models

To approach Quadruple Helix as an innovation model it is necessary to locate it in the context of innovation literature. Next we will describe the change in thinking of innovation processes from linear innovation model to innovation systems, regional and territorial innovation models and Triple Helix model, and finally to user-centric and Quadruple Helix models.

According to Edquist & Hommen (1999) the so-called linear model of innovation has been generally accepted throughout much of the period since World War II. A linear view of the innovation process means that science leads to technology and technology satisfies market needs. It conceives of commercial research and development as applied science and envisions a smooth, uni-directional flow from basic scientific research to commercial applications. In this kind of approaches, innovations were seen as great leaps of knowledge achieved by talented individuals or research groups. Innovations were also largely seen to be linear processes from the basic research to the market applications. There was even no feedback from the several later stages of the innovation process (i.e., product development, production, and marketing) to the initial stage of research, nor is there feedback between any of the other stages.

Problems with the linear model of innovation have been summarized by Kline and Rosenberg (1986). According to them, the shortcomings and failures that are part of the learning process that creates innovation mean that in both radical and incremental innovation feedbacks and trials are essential. Furthermore, they note that basic scientific research does not always lead to the design of innovations. Conversely, problems that are thrown up by the processes of designing and testing new products and new processes often spawn research and have in some instances even given rise to new branches of science. Technological innovations may also proceed independently of any interaction with science, although other types of interactions might be important.

The failures of the linear model have created a demand to foster other sources of innovation. The later theories of innovation have emphasised that innovations typically take place in normal, co-operative social and economic activities, being incremental, social and organisational changes as well as technological advancements and radical leaps. Therefore, the focus has shifted to interactive, non-linear innovation processes in multi-actor innovation networks. (Schienstock and Hämäläinen, 2001)

One way to take more multi-faceted look on the innovation is the system-oriented theory and research of innovation (SI). This view of the innovation process explicitly recognizes the potentially complex interdependencies and possibilities for multiple kinds of interactions between the various elements of the innovation process. It also accords great importance to the demand side, rather than concentrating primarily on the supply side (Edquist & Hommen 1999). The innovation system concept can be understood in both a narrow as well as a broad sense (Piirainen & Koski 2004). A narrow definition of the innovation system primarily incorporates the R&D functions of universities, public and private research institutes and corporations, reflecting a top-down model of innovation. A broader conception of the innovation systems is more interactive and bottom-up including 'all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring' (Lundvall 1992).

Edquist & Hommen (1999) argue, that SI approaches provide for a much more careful and detailed development of public policies for innovation than do variants of the linear approach. From an SI

perspective, policy is partly a question of supporting interactions in a system that identify existing technical and economic opportunities or create new ones. The degree of innovation opportunity should be the deciding criterion in allocating support for certain types of interactions and hence for certain technologies and sectors. Moreover, the feasibility of alternative directions for innovation must also be evaluated, so that policy does not remain "blind" and support all alternatives in an indiscriminate way. Policymakers should develop selection criteria, such as the impacts on economic growth and employment, while supporting the creation of novelty.

Wise and Høgenhaven (2008) say that just now there is again a need for a paradigm shift. The role of the users of the innovations is growing fast and one can even speak of user-driven innovation, which refers to tapping users´ knowledge in order to develop new products, services and concepts, and understanding of the user needs and involving the users more systematically to the innovation processes. Wise and Høgenhaven (2008) describe the evolution of innovation approaches as follows (see Figure 2).

Figure 2. Evolution of Innovation Frameworks (Wise & Høgenhaven 2008)
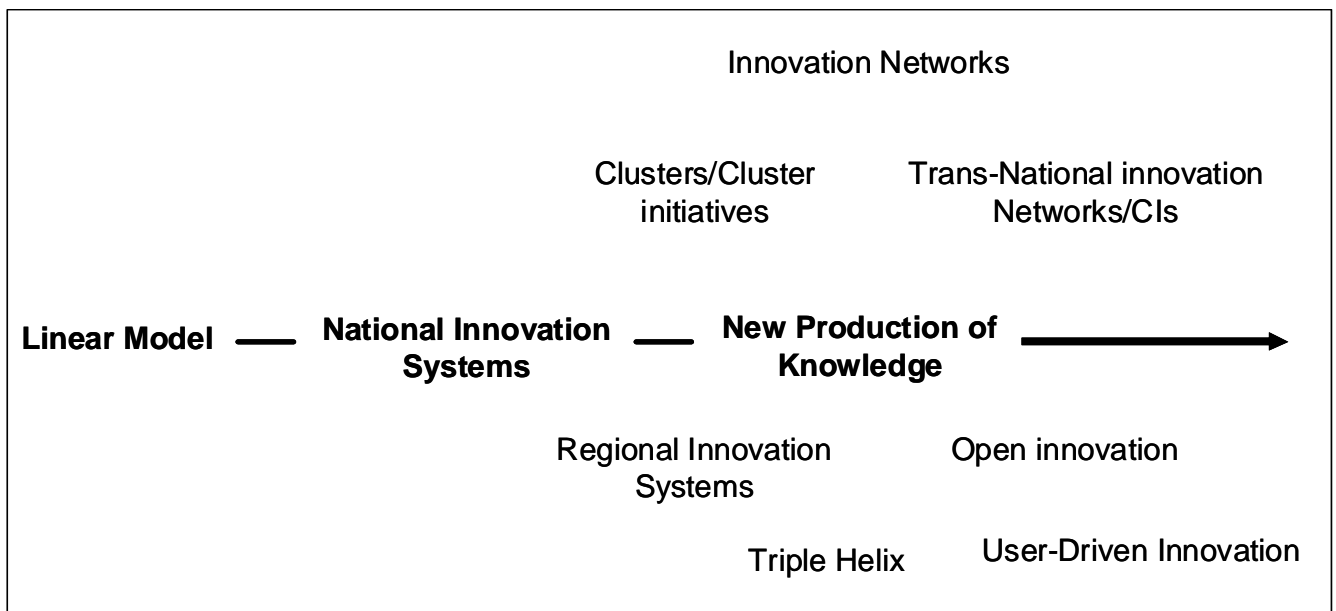
In Figure 2. we can see how innovation perspectives have evolved over time moving from linear to systemic models, and later to new modes of knowledge production. The later innovation theories and approaches emphasize that knowledge is increasingly created in broader, trans-disciplinary and besides economic, also in social contexts, in which the users of innovations have a great role to play. One can name these as open and user-oriented models of innovation.

In the next chapter we will take a closer look to the systemic and regional aspects of innovation. Then we move to the Quadruple Helix via the Triple Helix approach defining what is essential and perhaps also new in the Quadruple Helix approach compared to some previous innovation models.

3.1. Innovations in their environment: regional innovation systems

In the literature on innovation processes and policies the local and regional dimension has grown in importance in post-Fordist "learning economies" (Asheim 2007; Asheim et al 2003; Cooke et al. 2004). The main underlying argument is that territorial clustering provides the best context for the promotion of innovative firms based on sticky knowledge and localized learning. Governments and agencies at all spatial levels are seeking to stimulate innovation, and, consequently, innovation policy is put at the centre of policies for promoting regional and national economic development. At the regional level clusters and regional innovation systems have been looked upon as policy frameworks or models for implementation of long-term development strategies initiating learning-based processes of innovation, change and improvement (Asheim 2007).

To illustrate thinking of the regional dimension of innovation one may take a closer look at one of the most popular approaches, regional innovation systems. According to Asheim (2007) the regional innovation system (RIS) can be thought of as the institutional infrastructure supporting innovation within the productive structure of a region. An RIS is in place when the following two sub-systems of actors are systematically engaged in interactive learning (Cooke et al., 1998): first, the regional production structure or knowledge exploitation subsystem which consists mainly of firms, often displaying clustering tendencies; second, the regional supportive infrastructure or knowledge generation subsystem which consists of public and private research laboratories, universities and colleges, technology transfer agencies and vocational training organizations. Furthermore, Cooke et al. (1998) emphasize the mainly informal institutional context (i.e. norms, trust and routines) in which such interactive learning takes place.

Asheim (1998) distinguishes between three types of RISes (see also Cooke, 1998). The first type may be denoted as territorially embedded regional innovation systems, where firms base their innovation activity mainly on localized, inter-firm learning processes stimulated by the conjunction of geographical and relational proximity without much direct interaction with knowledge generating organizations (i.e. R&D institutes and universities). This type represents a market-driven non-systemic model, where demand factors determine the rate and direction of innovation. Cooke (1998) calls this type 'grassroots RIS'. These territorially embedded systems provide bottom-up, network-based support through, for example, technology centres, innovation networks or centres for market research and intelligence services, to promote the adaptive technological and organizational learning in territorial context.

Another type of RIS is the regionally networked innovation system. Firms and organizations are here also embedded in a specific region and characterized by localized, interactive learning. However, through the intentional strengthening of the region's institutional infrastructure - for example, through a stronger, more developed role for regionally based R&D institutes, vocational training organizations and other local organizations involved in firms' innovation processes - these systems have a more planned character involving public-private cooperation. The networked system is commonly regarded as the ideal-type of RIS and is characterized by mixed supply/demand interaction: a regional cluster of firms surrounded by a regional 'supporting' institutional infrastructure. Cooke (1998) also calls this type 'network RIS'. The creation of regionally networked innovation systems through increased cooperation with local universities and R&D institutes, or through the establishment of technology transfer agencies, may provide access to knowledge and competence that supplements firms' locally derived competence.

The third main type of RIS, the regionalized national innovation system, differs from the two preceding types in several ways. First, parts of industry and the institutional infrastructure are more functionally integrated into national or international innovation systems i.e. innovation activity takes place primarily in cooperation with actors outside the region. This type of RIS represents a science/supply driven model in which exogenous actors and relationships play a larger role. Cooke (1998) describes this type as 'dirigiste RIS', reflecting a narrower definition of an innovation system incorporating mainly the R&D functions of universities, research institutes and corporations.

In a critical review Moulaert & Sekia (2002) use the concept of Territorial innovation model' (TIM) as a generic name for models of regional innovation in which local institutional dynamics play a significant role. Moulaert & Sekia (2002) list six territorial innovation models: innovative milieu, industrial district, regional innovation systems, new industrial spaces, local production systems and learning region. Moulaert & Sekia (2002) conclude that these approaches are following market logic only and that they exclude some important dimensions of innovation. In their view regional development approach should be based on a multi-dimensional view of innovation, economic dynamics and community governance. Territorial development does not only mean enabling the local and regional market economy, but also empowering the other parts of the economy (public sector, social economy, cultural sector, low-productivity artisan production) as well as community life (socio-cultural dynamics as a level of human existence by itself, political and social governance of non-economic sections of society, cultural and natural life). The same deficiency can be found in national innovation system approach/literature. Almirall and Wareham (2008) argue that a close look at the most relevant activities presented in different national innovation system descriptions easily reveals the absence of both user and societal involvement in the innovation process.

As the focus of this research is QH innovation, one more of the systemic innovation models needs to be taken under a closer look. It is the Triple Helix model (TH), which can be seen as a forefather of the QH model.

3.2. Triple Helix

In 1995 Etzkowitz and Leydesdorff proposed that the three major parties in innovation are industry (wealth generation), universities (novelty production) and public control (government). They observed that the new environment for innovation is characterized by the strong role of universities, the active engagement of all levels of government in formulating policies, the strategic alliances of firms in developing and marketing products and product and process innovation within industry, and the emergence of science-based technologies that originated in academia and were encouraged by the government policies (Etzkowitz 1998).

The Triple Helix model was initially derived from an analysis of the renewal of the Boston economy, through a university–industry–government collaboration for firm-formation from academic research in the 1930s (Etzkowitz 2002). A region with a cluster of firms, rooted in a particular technological paradigm is in danger of decline once that paradigm runs out. It was already apparent, early in the 20th century, that it was necessary to replace firms whose technologies and products had been superseded, or whose businesses had moved elsewhere. The need to renew the industrial base is an increasing national and regional concern. It leads government, as well as companies and universities, to explore ways for knowledge producing institutions of making a greater contribution to the economy and society.

In Triple Helix (TH) innovation model academia (colleges, universities), government and industry constitute the three helices which collaborate with each other in order to create or discover new knowledge, technology, products and services (see Figure 3). In this innovation model universities and science-based technologies originated in academia have a strong role. The role of government is in formulating policies and supporting the development of science-based technologies, the strategic alliances of firms developing and marketing products and doing product and process innovations. (Etzkowitz 1998; 2003; Leydesdorff & Meyer 2006)

Figure 3. Triple Helix.
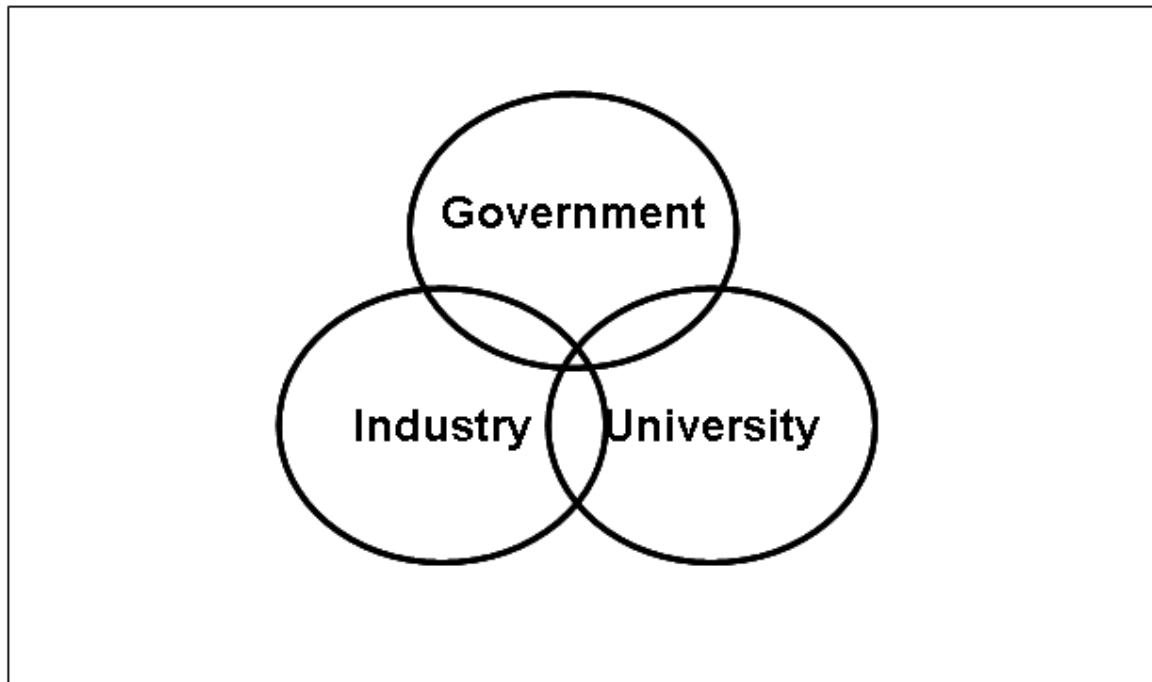
The Triple Helix model has evolved and gone trough three different development phases. In Triple Helix I the three helices are defined institutionally. In Triple Helix II more attention is attached to the communication within the system and to the different knowledge systems. The Triple Helix III focuses in the hybrid organizations of academia, government and industry. (Torkkeli et al. 2007).

The Triple Helix introduces a lateral approach into innovation policy, conceived as collaboration among the institutional spheres. Thus, as in RIS approach, rather than solely a 'top down' initiative of national government, innovation policy should also be seen as the cumulative result of interaction among governments at various levels, businesspersons, academics, and NGOs comprising membership from all of these spheres, especially at the regional level. Networks are generated from a variety of sources; they may emanate from collaborations between large firms and academic researchers, or they appear informally among firms in a common area of activity which then may be formalized into a 'valley' through the organization of an association.

As an innovation approach and innovation policy instrument TH model has its limitations. For example, Etzkowitz & Klofsten (2005) have examined TH at the regional level and argued that relatively few regions have exhibited "self-renewing capabilities" created by a developed TH model, a continuous flow across technological paradigms, moving beyond creative destruction to creative reconstruction. (Etzkowitz, Klofsten 2005). More importantly, according to Yawson (2009) the Triple Helix of state, university and industry is missing an essential fourth helix, the public.

Advances in biotechnology and nanotechnology are jeopardized by the virtual absence of this helix. Disciplinarity is no longer the dominant system for creating and organizing knowledge. Knowledge creation is now trans-disciplinary, more reflexive, non-linear, complex and hybridized. Furthermore, inclusion of the fourth helix becomes critical since scientific knowledge is increasingly evaluated by its social robustness and inclusivity. Public interest is important in this regard. The fourth helix highlights new discoveries and innovations that improve social welfare, e.g. eco-innovation. It helps to create linkages between science, scientists and education strategies. There are also some other reasons to replace Triple Helix with Quadruple Helix. We become acquainted with them in the next chapter which considers Quadruple Helix innovation model.

3.3. Quadruple Helix as a user-oriented innovation approach

The Quadruple Helix (QH) is a not very well-established and widely used concept in innovation research and in innovation policy. The concept also has no well-established definition. There is a wide range of conceptions which could be named as QH type of innovation conceptions. Some of them are very close to TH concept, some of them deviate more radically from it and many of them are somewhere between these two extremes. What is common to all QH type of innovation conceptions is that they all have included some fourth group of innovation actors to the TH model.

Some argue that it is the 4th pillar organisations creating links between the Triple Helix organisations, which should be included in the TH innovation model (Liljemark 2004). Some have called these 4th pillar or intermediate organizations as innovation-enabler organizations (Liljemark 2004). They act as brokers and networkers between the TH organizations. This 4th pillar approach is only a minor step beyond the Triple Helix models and it resembles very much the innovation system concepts presented earlier. Yawson (2009) argued (see above) that the missing fourth helix should be the public. Another candidate as the fourth helix is the user, which is very close to Yawson's candidate, the public. This choice is supported by the opinions brought forward in recent innovation research and policy, which present user-driven innovation as an essential factor of success for both firms and public sector organizations (Eriksson et al 2005; Lundvall et al. 2002; Thomke & von Hippel 2002; Schienstock & Hämäläinen 2001). One important reason for this is the changed competition situation of companies. It is seen that with increased global competition and cheaper sources of high-quality technological solutions, companies can no longer rely on maintaining a competitive advantage based on 'traditional' drivers of price and quality. Companies must strive to seek alternative sources of competitive advantage, and are therefore undertaking major transformations in their innovation processes and business models in order to deliver more valuable products and services to the market. These new innovation strategies of firms often involve increasingly open business models, a greater focus on understanding latent consumer needs, and more direct involvement of users in various stages of the innovation process. User-driven innovation practices are also believed to support the renewing of public sector and public services facing financial difficulties (Finnish Ministry of Employment and the Economy 2009). User-driven innovation approach is believed to promote the development of new more inexpensive public services and ways of operating them (Wise 2008).

User-driven innovation approach could be seen as one essential element of new "broad-based innovation policy" approach (see Edquist et al. 2009). The broad-based innovation policy entails the broadening of the concept of innovation to include product innovations in services, as well as organizational process innovations; and relates to not only economic significance, but also wider societal benefits, as well as to measures targeted to supporting innovation in public services. This new innovation policy conception takes also all determinants of the development and diffusion of

innovations into account, when designing and implementing innovation policies. This would then include policy instruments operating from the demand side. It would also include acknowledging a wider spectrum of sources of knowledge and more versatile interactions with producers and users of knowledge. (Edquist et al. 2009)

The concept "user-driven innovation" was originally connected to innovations carried out by a consumer to increase the utility value of a given product, as opposed to a company innovation, which solely serves a commercial purpose. Recently the concept user-driven innovation has often been used in the context of companies involving users in various ways in the innovation process (Wise & Høgenhaven 2008). The use of "user-driven innovation" as an umbrella concept for describing all kinds of innovation activities, in which users are involved, is a bit problematic. It suggests for the user a bigger role in innovation activities than this role often actually is. From this perspective a more proper term could be user-centred, as suggested by Bergvall-Kåreborn et al. (2009), or user-oriented. This is why we prefer in this research report these two concepts instead of user-driven.

From the point of view of these new user-oriented innovation strategies it is arguable that the fourth helix of QH should be the user. This is also the approach we have chosen in our research. The concept "user" can be interpreted quite widely (see next chapter "3.4. Defining user and user involvement") and we have also done so. For example the concept "public" can be seen to be included into this concept. Choosing user as the fourth helix of QH in our research could also be justified by the long term aim of CLIQ project, which is to optimise the benefits of globalisation and innovation to SMEs and entrepreneurs in medium-sized towns. User-oriented QH model is seen beneficial especially to SMEs (see below).

The Quadruple Helix type of innovation activity enables larger variety of innovations than the Triple Helix model does. The Triple Helix type of innovation activity is focused on producing high-tech innovation based on latest technology and research knowledge. Because of this the Triple Helix model is considered to lend itself better for science-based high-tech companies than for other kind of businesses (see MacGregor at al. 2009). The Quadruple Helix type of innovation activity, instead, can be focused on producing other kind of innovations, and on applying existing technology and research knowledge, and user knowledge, too. To SMEs the increase of quadruple and user-oriented type of innovation activities could open up new possibilities to participate in innovation activity, as also other types of SMEs could participate than strongly science-based ones, or firms having science-based firms as clients. The representatives of Living lab approach, for example, even argue that the QH type of innovation activity, in which the users are highly involved, can help the SMEs to shorten the incubation time and to manage and minimise the risks associated with the development of new products and services (Santoro & Conte 2009). This type of innovation activity is also believed to be attractive to SMEs, micro-organisations and start-ups, which typically have problems in acquiring venture capital, unless the market attractiveness of ideas, concepts, products and services can be reasonably demonstrated (Eriksson et al. 2005). Many authors have pointed out that the development possibilities of SMEs are very much dependent on how well they can involve users in their innovation activities.

As to the relationships between RIS approaches and QH, one may note that QH is not an isolated phenomenon, but located in an existing network of actors and RIS modifying it. Thus one may see QH as complementary or an extension to other RIS approaches. Depending on the respective case from the viewpoint of RIS, QH represents itself as a complementary dimension in RIS-like innovation in taking notice of the user and the community at large (users, citizens), or simply a different kind of way to foster regional innovation. However, it is quite clear that not all innovation

processes or QH-models are spatially specific in the way described in the RIS literature. For example social media is in principle placeless.

As the TH can be seen as a systematic way of pursuing research/technology-driven innovations, so also the QH can be seen as a systematic way of pursuing demand- or user-oriented innovation. Quadruple Helix is a very wide and multidimensional concept referring to numerous different activities and actors. It seems that it is more reasonable to consider QH as a continuum or even as a space rather than a single model. Therefore it could be more meaningful to talk about QH models than a QH model. At the end of this research report we will form four different QH models, which bring forward some interesting dimensions and challenges of QH type of innovation activities and environments (see Chapter 6. Research results).

3.4. Defining user and user involvement

Now we have concluded that users should be the fourth helix of QH. But what we and the proponents of user-oriented innovation mean when we are talking about users and user involvement in innovation?

There are several definitions of the users. Depending on context, users can be ordinary or amateur users, professional users, consumers, employees, residents, citizens, hobbyists, businesses, organizations, civil society associations. Eason (1987), for example, differentiates three categories of users: (1) primary users, those likely to be frequent hands-on users of the system; (2) secondary users, those who use the system through an intermediary; and (3) tertiary users, those affected by the introduction of the system or who will influence its purchase. One can also differentiate users from non-users, who are those who actively choose to limit, completely or partly, the use of some products or services in their homes and private lives (Selwyn 2003). One can also differentiate lead users from ordinary users. Lead users are defined as those who are in the leading edge of an important market and so are currently experiencing needs that will later be experienced by many users in the same market. In addition, they anticipate relatively high benefits from obtaining a solution to their needs, and so may innovate (von Hippel 2005, 1986; von Hippel 2001). A consumer is the person who both pays and uses the product. (Ståhlbröst 2008, 12-13)

Figure 4. Different user groups.
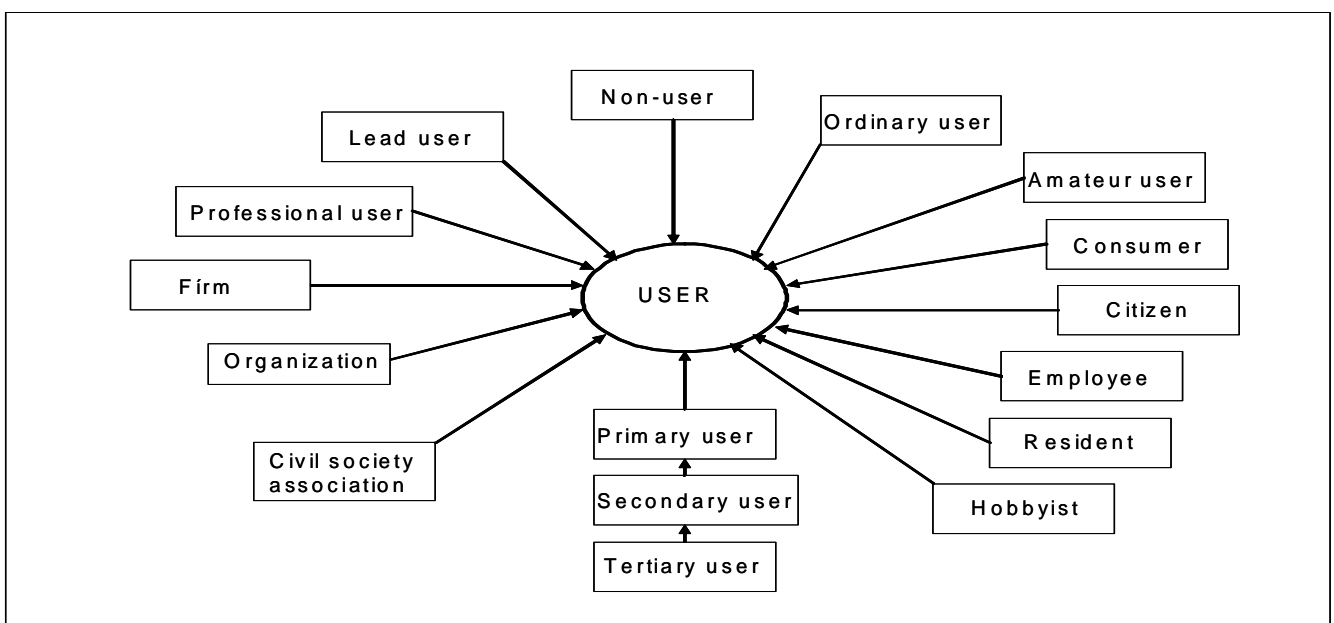
Besides the fact that there are several different kinds of users, what makes the concepts user-oriented innovation and QH user involvement even more multidimensional, is the fact that there are also numerous different ways and degrees of user involvement. The numerous ways and degrees, in which users can participate in innovation activities, range from very indirect ways of participation to very direct ways of participation. An example of one indirect way of participation is a user questionnaire which is sent to the users in order to find out what kind of needs they have in relation, for example, to certain products or services. An example of a direct way of participation is that users participate in the development work of new services together with the R&D experts. One simple (and practical) manner to the differentiate various ways and degrees of user involvement is to divide the involvement into three categories: for, with, and by (Bekker and Long 2000; Eason 1987; Kaulio 1998). The first type, design *for* users, means that the product or service is developed on behalf of the user. Data about the users, general theories, and models of users' behaviour are used as a base for the design. This approach often includes specific studies of users, such as interviews or focus groups. In this perspective, the users are involved relatively late in the development process, with the focus on verifying requirement specifications and prototypes (Ståhlbröst 2008). The second type, design *with* users, denotes a product development approach, focusing on the user, utilizing data on user preferences, needs, and requirements as in a design for approach, but, in addition, includes a demonstration of different solutions/concepts for the users, so they can react to the differing design solutions. Here, the users are involved throughout the process and are on equal terms in co-creation of future solutions based on their needs and experiences. This is represented by the two persons sitting next to each other in the car. In this perspective, the designer is active and in charge of design and development activities (driving the car) while the user is active and in charge of context and evaluation activities (reading the map and giving the directions) (Ståhlbröst 2008).

In the third type of user involvement, design *by* users, a product development approach is applied, in which the users are involved actively and partake in the design of their own product. Here, users are involved in the role of process initiators; hence, they drive the process. In this design perspective, users contribute with inspiration and ideas; they produce content and they develop products or parts of products. The role of the designer is to be the facilitator, being in front of the car and paving the way for the user driving the car. This means that the designer still has influence over what is possible to do or where to go, but the user decides how, when, and if s/he wants to follow (Ståhlbröst 2008).

Firms and universities have used some kind of consumer and user research as part of their development work for a very long time. Therefore it is arguable that the users have been involved also in the Triple Helix type of innovation activities, even though their input is often left without explicit mention in TH context. How then can we differentiate user involvement related to TH from the user involvement related to QH? If the very indirect ways of user participation are included in the QH innovation model, then in practice it becomes very difficult to differentiate it from the Triple Helix innovation model. Rosted (2005) has argued that one can talk about user-driven innovation, when a company utilizes in its innovation process knowledge on user needs collected through scientific and systematic surveys and tests. This can be considered also as a minimum requirement for user involvement related to QH innovation model. In other words, user involvement in QH innovation model can range from the systematic collection and utilization of user information to the development of innovations by the users themselves.

What comes to the umbrella concepts describing all kinds of user involvement (e.g. user-driven), Bergvall et al. (2009) argue that the concept user-driven should to be aligned only with the concept "design-by users". In other words, this concept should be connected only with innovation activities in which the user or users are the true initiators of an innovation process. They also argue (2009)

that "If we want a concept that brings all user involvement concepts under the same umbrella, we suggest the user-centric concept." As we have mentioned earlier, we use both user-centric and user-oriented concepts as an umbrella concept for user involvement in this research report (see Figure 5).

Figure 5. Difference between umbrella concepts user-driven and user-centric/user-oriented.
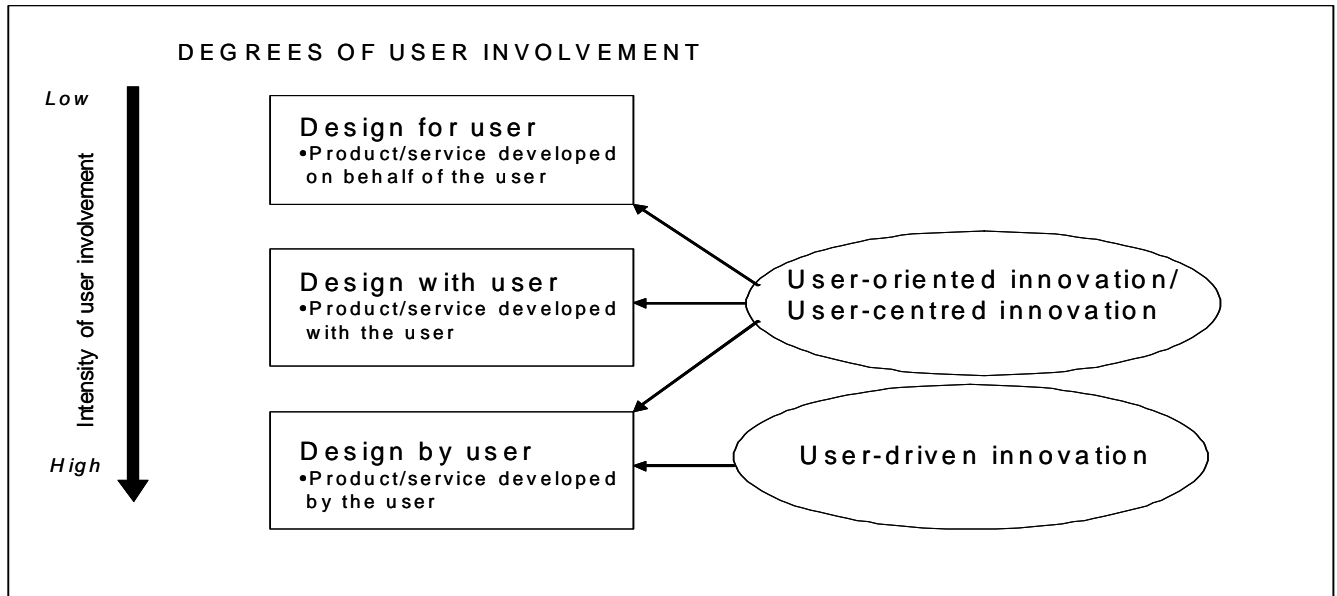
In the innovation literature users are often considered from the point of view of markets, firms and commercial activities. From this perspective users become to be seen as consumers, buyers of products and services. Users can also be considered as active citizens who are trying to have an effect on the decision making concerning them in both private and public sector. The role of users may be even more complicated in the case of the introduction of public services. Dibben and Bartlett (2001) found in their study that in the public services user involvement can be divided into two strands: an approach which focuses on the role of the service user as a mere consumer of services (consumerist), and one that emphasizes a clearer role in decision making (collectivist). By focusing on the first approach and neglecting the second means that the issue of democratic decision-making is not addressed. Hence, it does not change the position of those on the receiving end of the services. Turning to the collectivist approach, which implies for user a role in decision making, this has been further divided into representative democracy and direct democracy. The former implies the role of councillors as advocates, and the latter suggests that the public have a direct input into how the services should be provided. Taking the idea of direct democracy further, Hoggett and Hambleton (1987) identify three types of strategy for involving the public in decision making: resourcing non-statutory organisations, community development, and the involvement of user groups.

However, the authors accept that both strands of a collectivist approach can be criticized. It has been argued, for example, that representative democracy might be paternalistic, passive and minimalist, and on the other hand, direct democracy could be sectional and parochial. Therefore, they recommend using a combination of the two types of approach in order that one might compensate for the deficiencies of the other.

Clarke and Stewart (1992) go even further and suggest that there should be a third facet to user's role: rather than being perceived as individuals, the public should be regarded as members of the community. They then link each of the three roles specifically to the idea of empowerment, and explain the type of action that they might imply in practice. In this model, empowering the public as

a customer involves extending choices or clarifying the service to which they are entitled, giving them the means to complain, and providing equality and ease of access. In contrast, by empowering people as citizens, the public are entitled to a share in decision making, which necessitates being clear about their rights. And, thirdly, empowering the public as community means giving them direct control, and the right to determine wherever possible those issues affecting the community, with the creation of new democratic frameworks where appropriate. This seems to suggest, then, that whichever of these roles is addressed, there are implications for ensuring that relevant systems and procedures are in place in order to enable user involvement. Clarke and Stewart (1992) recommend that there should be a balance between the focus on the public as customer, as citizen and as community.

In Table 1 (see below) there is a summary of the different user-oriented innovation concepts presented in this chapter. We can see from that table that both the concepts 'user' and 'user involvement' are very wide and multidimensional. This means that also user-oriented innovation and QH are very wide and multidimensional concepts. For example, user involvement can range from developers making assumptions about users' needs without actually involving users, to users' developing the final product or service themselves (Ståhlbröst 2008). On one extreme one can talk about user-oriented innovation when a company utilizes in its innovation process knowledge on user needs collected through scientific and systematic surveys and tests (see e.g. Rosted 2005). This type of user-oriented innovation conception differentiates itself very little from the Triple Helix models. On the other extreme there is that type of user-oriented innovation, in which the user has a very active and influential role in the innovation process and in where the user participates intensively in all phases of innovation process (see e.g. Eriksson et al. 2005). In this type of user-oriented innovation the user can be seen as a co-producer of innovation, having an equally important role in innovation process as the research organizations, public supporting organizations and businesses (Eriksson et al. 2005). This kind of QH innovation activities differs quite significantly from the TH type of innovation activities. Furthermore, there are numerous other QH innovation approaches between these two extremes.

Table 1. Summary of different user-oriented innovation concepts

Different groups of users	• non-user • ordinary/amateur user • consumer • citizen • employee • resident • hobbyist	• lead user • professional user • firm • organization • civil society association	• primary user • secondary user • tertiary user
Different degrees of user involvement	***Design for user*** • Product/service developed on behalf of the user	***Design with user*** • Product/service developed with the user	***Design by user*** • Product/service developed by the user
	User as consumer	**User as collectivist**	**User as individual or member of community**
Perspectives/ possibilities of user involvement in public sector	1. Buys the product/service developed 2. Does not buy the product/service developed	***1. Representative democracy*** • Councillors advocate users ***2. Direct democracy*** 1. Resourcing non-statutory organizations 2. Community development 3. Involvement of user groups	***1. Citizen is empowered by*** • Extending choices or clarifying services he/she is entitled to • Giving means to complain • Providing equality and easy access ***2. Member of community is empowered by*** • Giving direct control and right to determine issues affecting community

3.5. Practical user-oriented concepts

There are several perspectives on contemporary innovation and adoption processes which all share the relevance of the user. Pascau and van Lieshout (2009) have named three essential user-oriented innovation concepts as Living labs, open innovation, and social computing. They compared these concepts with each other and argued that they all emphasize different aspects of contemporary innovation processes (see Table 2).

Table 2. Comparison between the relevant dimensions of the three user-oriented innovation concepts (Pascau & van Lieshout 2009).

	Living labs	Open innovation	Social computing
Main actors	Citizens-firms	Firms	Citizens
Main orientation	Improving on development of useful services through interaction in "daily life" setting between developers and users	Improvement on development of new services/products through cooperation between firms	Applications enabling interaction and collaboration, providing wider access to services and enabling users to become co-creators (not just end users)
Main concepts	"Mutual shaping" (Oudshoorn and Pinch) "User centred innovation" (Steen)	"Open innovation" (Chesbrough)	"Long tail" (Anderson) "End user innovation" (von Hippel)
Form/modus of cooperation	Geographically bounded innovation environments	Clusters of firms	Virtual cooperation
Role of government	Active engagement, public-private partnership	Stimulating, innovation policy	Reactive, responding to changing relations
Prime examples	European Network of Living labs Arabianranta (Helsinki) I-City Leuven	IBM Innovation Jam Linux	Blogging, social networking, including videosharing (e.g. Youtube) and photo-sharing (e.g.Flickr) Collaborative content (e.g. Wikipedia) Social tagging (e.g. deli.cio.us) Social gaming (e.g. Second Life) Shared product/service development (Vodafone, Betavine, Habbo Hotel)

Within Open Innovation it is usually clusters of firms cooperating in open innovation processes. The concept "open innovation" is created by Henry Chesbrough (2003). According to him (2003) the open innovation paradigm can be understood as the antithesis of the traditional vertical integration model where internal research and development (R&D) activities of a firm lead to internally developed products that are then distributed by the firm. Chesbrough's open innovation approach treats R&D as a more open system and suggests that valuable ideas can come from inside and 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 idea. In Chesbrough's open innovation concept the businesses are in the centre and typical users are other firms (buying the products or services produced by another firm). It should be noted that there are also other kinds of interpretation of open innovation than Chesbrough's firm-centric interpretation. For example, in von Hippel's (2005) open innovation concept it is the lead users and user communities which are in the centre. In this user-centric context open innovation means that the users share their development ideas with other users.

Within Social Computing virtual communities of users form the kernel of the innovation activities. These communities are usually fluid: users come and go, though specific kernel of core users can be

identified that are actively dedicated to maintaining an open periphery. Within social networking sites the number of real active users is limited, while the range of followers is much larger. The real active users are those that lead the others. However, contrary to innovation practices in firms, within social computing the number of lead users can be potentially very large, leading to a very fragmented and segmented market with a high number of potentially interesting niches ("Long tail"). In Social Computing it is the user, which is in the centre of this innovation model, and typical users are creative and active end-users of different ICT and mobile services.

Living labs are "innovation environments" or "innovation arenas" having participation of designers, engineers, users, suppliers, industrialists, public actors and other involved parties as a conscious principle (Pascau & van Lieshout 2009). Also living labs are often referred to as an example of open innovation or open innovation environment. But in this context open innovation refers to open development and innovation co-operation between living lab actors, it does not necessarily mean the same as in Chesbrough's definition (see above), which refers mainly to open innovation co-operation between firms. In the following chapter we give a more detailed description of living labs.

3.6. Living labs as user-oriented innovation environments

From the QH perspective living labs could be considered a more interesting innovation approach than open innovation and social computing introduced above. The main reason for this is that in living labs all four important actor groups of QH model are actively present: users, firms, public research organizations and public authorities. Living labs are interesting also from the perspective of public authorities and SMEs. Living labs are often public-private partnerships, and Pascau and van Lieshout (2009) argue that public authorities may have an important role within living labs. They can, for example, contribute to goal-setting and formulating public policies around them. Within open innovation the role of governments is more traditional, and it is often related to creating beneficial conditions for firms to innovate and to realise economic prosperity (Pascau & van Lieshout 2009). In social computing, the role of government is more modest, limiting often to more generic policy activities (Pascau & van Lieshout 2009).

Santoro and Conte (2009) argue that there are some fundamental factors hindering the realization of SMEs innovation potential:
- An insufficient ability of vertical integration of complementary competencies at SMEs level. SMEs must be organized in collaborative networks, which can aggregate pools of complementary resources and competencies.
- A lack of mechanisms and processes for the use validation of business opportunities originated by the industry, especially if the targeted market is characterized by the classical dilemma technology push or market pull.
- Scarce availability and/or difficult access to knowledge resources, necessary to support the innovation process within SMEs.
- An insufficient readiness to collaboration of SME workers, who are in general not used to collaborate with other SMEs.
- Lack of legal competencies necessary to manage IPR created during the project and to leverage the background;
- Lack of consolidated processes for allowing the involvement of Customers, End-users and Citizens in the development process of new products and services.

Given the bottlenecks hampering SME innovation, Santoro and Conte (2009) claim that there is a need to revise the current approach to regional innovation support going beyond traditional clusters

and incubation support approaches. They also argue that a revised regional innovation model could benefit from the living labs concept, and it should include the characteristics of user driven open innovation, integrating elements such as the creation of thematic innovation communities, establishment of collaborative networks of SMEs, and building living labs innovation facilities (Santoro & Conte 2009).

Living labs have been seen as a first attempt to structure and provide governance to user involvement in a way that can be addressed by companies, research institutions, public organizations and policy makers. Living labs could be seen as a supplement to traditional cluster and regional innovation policy and as a new kind of intermediary organization, which supports the involvement of users in the R&D&I –activities (Almirall & Warenham 2008).

The concept of living labs originates from Professor William Mitchell in Boston, MIT, and was initially used when users were observed as they lived for a period of time in a smart/future home (Eriksson et al. 2005). Svensson et al. (2010) argue that today, especially in Europe, this concept is often used to "enhance innovation, inclusion, usefulness and usability of ICT and its applications in the society". The application possibilities of living labs do not constrict to ICT. They have already been used in several areas of development and business, including telecommunication, health, well-being, housing, tourism, energy, and governance. Besides business, this innovation model can also be applied in public sector (incl. in the development of public services). In addition to innovation, this concept plays also other roles, for example, in entrepreneurship and venturing, in technology transfer, in promotion and development of cities and regions (Almirall & Warenham 2008).

There are many definitions of what a living lab is. The concept of living labs can be seen as a methodology, an organization, an environment and/or a system (Svensson et al. 2010). Eriksson et al. (2005) have been describing Living Lab as "a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts". According to the European Network of Living Labs (http://www.openlivinglabs.eu/) a living lab is "both a methodology for User Driven Innovation and the organizations that primarily use it". The European project CoreLabs (http://www.amicommunities.net/wiki/CORELABS) defines living labs as "a system enabling people, users/consumers of services and product, to take active roles as contributors and co-creators in the research, development, and innovation process". From this system perspective living labs could be seen as small-size regional innovation systems. This is supported by the fact that they often are situated into a certain geographical location, for example, in a city or a city district (Pascau & von Lieshout 2009). Ballon et al. (2005) present yet another definition of living labs: "An experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered 'co-producers'."

In short, the goal of living labs is the creation of "innovation arenas" where multiple actors can experiment in an open, real life environment. Living labs could be seen as development platforms which are trying to promote user centred R&D&I –activities. This is done, firstly, by giving to the users a possibility to participate in the innovation process as co-designers and co-producer (Pascau & van Lieshout 2009), and secondly, by studying them and how they use certain products or services in real life contexts, i.e., in the environment in which the users normally live and work. Living lab experimentation environment specialized in technological development typically includes (Eriksson et al. 2005)

- two or more state-of-the-art technologies;
- firms (large and SMEs);
- various organizations that utilize technology or are candidates to utilize technology in the vertical dimension of a value-chain;

- public organizations;
- users/consumers/citizens; and
- research organizations.

Living labs provide a wide range of services and play diverse roles in the quest for articulating user involvement, from support to leading entrepreneurial users to needs-finding or user experience services (Almirall & Warenham 2008). They also can provide same kind of development and support services to businesses as science and business parks do. Almirall & Wareham (2008) argue that living labs are especially suitable for customization or localization exercises, explanatory exercises in large solution spaces with alternative technologies or interdisciplinary projects linked with organizational changes. According to Eriksson et al. (2005) by integrating the consumer into the development process living labs ensure a highly reliable market evaluation, resulting in a significant reduction of technology and business risks. Therefore this approach is particularly attractive to SMEs, micro-organisations and start-ups, who typically have problems acquiring venture capital unless the market attractiveness of their ideas, concepts, products and services can be reasonably demonstrated (Eriksson et al. 2005).

Ballon et al. (2005) position living labs relative to field trials, prototyping, societal and market pilots and test beds (see Figure 6 below). These different test and experimentation platforms are defined in Table 3 below. According to Ballon et al. (2005) living labs share with test beds, field trials and prototyping the technological architecture and environment in which specific ICT products may be developed and tested. With market pilots and social pilots they have in common that they also experiment and test user preferences and viable business models (Ballon et al. 2005). Living lab concept is closest to concepts like prototyping and testbeds by being situated somewhere between design and testing phase. Pascau and van Lieshout (2009) argue that living labs differ from traditional test beds in that they are far less top-down controlled by the designers and that they are made in a real-life context instead of a controlled laboratory like context. Test beds and living labs differ from each other also in that sense, that in test beds usually only technology is tested, but in living labs also the services, business model etc. related to new technology are tested. (Ballon et al. 2005).

From field trials living labs differentiates itself by being more open to different possible solutions and lasting longer. Field trials are also considered more appropriate for validating a technical solution developed, as living labs are more appropriate for finding new unexpected solutions and for developing new services, products and uses of devices (Ballon et al. 2005, Pascau & van Lieshout 2009). Ballon et al. (2005) claim that living labs are breeding places for innovations which have not been considered at beforehand by designers, because they offer the opportunity to share risks and mitigate investments and they foster dialogue between developers and users. According to Almirall & Wareham (2008) living labs have approved to be suitable for supporting the implementation of interdisciplinary projects with multiple alternatives and business models. (Ballon et al. 2005, Almirall & Wareham 2008)

Figure 6. Conceptual framework of test and experimentation platforms (Ballon et al. 2005)
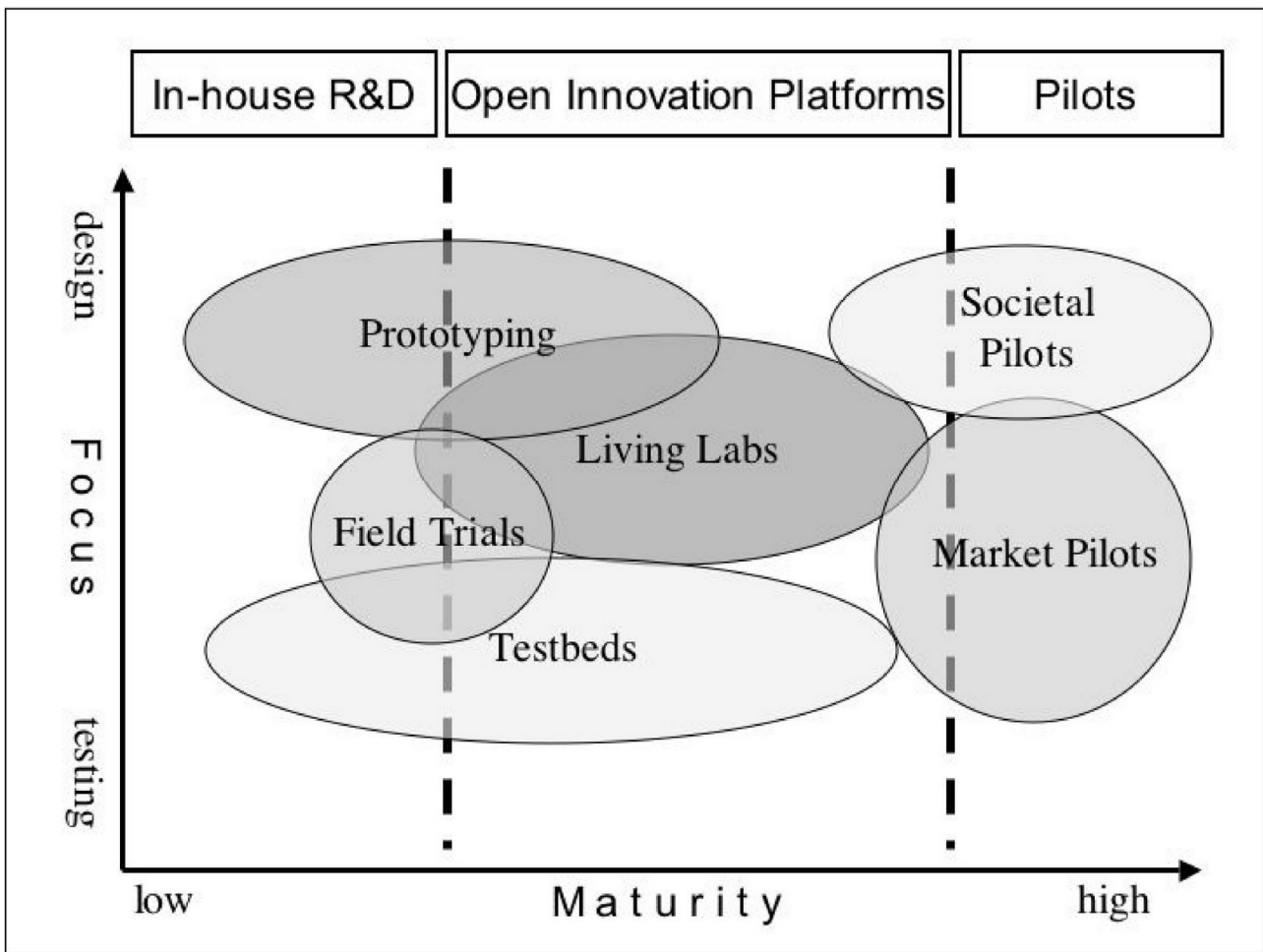
Table 3. Test and experimentation platforms (Ballon et al. 2005)

Prototyping platform	A design and development facility used prior to mass production and resulting in the first proof-of-concept of a new technology, product or service
Testbed	A standardized laboratory environment used for testing new technologies, products and services and protected from the hazards of testing live or in production
Field trial	A test of technical and other aspects of a new technology, product or service in a limited, but real-life environment
Living lab	An experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered 'co-producers'
Market pilot	A pilot project in which new products or services that are considered to be rather mature, are released to a certain number of end users in order to obtain marketing data or to make final adjustments before the commercial launch
Societal pilot	A pilot project in which the introduction of new products and services into a real-life environment is intended to result in societal innovation

Følstad (2008) found that in the living lab literature co-creation and insight in context of use are often seen as important keys to innovation. He believes that this perspective could serve to establish a unique living lab identity that clearly could separate living labs from related innovation

environments. However, it should be noted, that the actual living lab actors have interpreted and implemented living lab concept rather freely and flexibly. In other words, in reality it is very difficult to differentiate living labs from other kinds of test and experimentation platforms as, for example, from testbeds (see Følstad 2008, Orava 2009).

4. Good QH cases

On the basis of both theoretical-conceptual analysis and innovation literature review we conducted a critical "screening" of good practice QH cases for analysis. The aim of this chapter is to 1) help you to build a concrete conception of QH type of innovation activities, 2) to introduce methods needed for creating user communities and for utilising user knowledge in organization's development work, and 3) to find challenges and good lessons and practices related to the implementation of QH type of innovation activities and environments.

The selection criteria for the good QH cases have been, first and foremost:
• The case clearly differentiates itself from the Triple Helix type of innovation activity, it represents the QH type of innovation activity, in which all four QH actor groups are involved, and in which the users have had an essential role;
• That there is an in-depth and rich enough description available of the case and this description entails experience-based real knowledge of the case.

As we went through numerous QH related papers, we came into same type of conclusion as Følstad (2008), who argues that there is a remarkable lack of in-depth descriptions and discussions of living lab processes. The same seems to go also with the QH type of innovation activities in general. This restricted our possibilities to select good QH cases. However, we managed to find an interesting and rich sample of QH cases, which hopefully elucidates, in different ways, some key aspects, practicalities and challenges of creating user-oriented innovation and development models.

First, we present some approved methods of user involvement. One of the key challenges of QH type of innovation activities is related to the successful involvement of users. In order to succeed in this one needs to know, for example, how to find the right users amongst a large group of heterogeneous users, how to motivate them to participate in the development work and how the information and ideas of users can be effectively and systematically collected and utilized.

It should be noted, that the selection of cases has not been guided by the importance of certain sectors, industries or regions. Instead, each case is thought to illustrate some important dimension of the QH phenomenon at the general level, and in that way may be helpful in building QH type of innovation co-operation in specific cases related to different sectors (incl. public sector), industries or regions. Accordingly, although three out of four user-involvement method cases presented here are situated in the private sector, they all can provide good lessons also for the public sector. All user-involvement concepts and methods presented here can also be applied in the public sector (Ling 2002). Of course these methods cannot simply be transferred to the public sector. Differences related to innovation constraints in private and in public sector have to be taken into consideration. The three key differences between the public and private sectors in this respect are according to Hood and Rothstein (2000):
• Primary Unit: Within the private sector the primary unit within which innovation is assessed is the enterprise or cost centre, whilst in the public sector the primary unit is more likely to be a complex open system such as urban renewal or criminal justice.

- Value: In the private sector the ultimate driver of innovation is shareholder value, which is an extremely straightforward objective to define, when compared to the public sectors' primary value objective, which is to satisfy 'public interests'.
- Legislation: Whilst private enterprises have an obligation to operate in accordance with the law, legal constraints on public organisations and bodies (for example concerning freedom of information and natural justice) impose greater limits on the way in which they can innovate.

Second, after presenting user-involvement methods, we introduce four living lab cases, which provide good lessons and practices to be learned from the implementation of QH type of innovation activities. From these cases we can learn, for example, what kind of important factors one should take into consideration when implementing or running QH type of innovation environments and how one can set up a QH type of innovation environment or development platform.

4.1. Involving lead users

Target organization	3M company in USA
Date	1996
What is presented here	Lead user method/process implemented in 3M company
What can we learn from this case	This case gives details about the so-called lead user method, which takes you to the learning lessons of an intensive user-involvement process related to lead ("pioneer") users.

Lead user method is a user involvement method/concept, which have been relatively widely applied (Ozer 2009). The theory behind this method is developed already in mid 1980s by Eric Von Hippel. Lead user theory was originally proposed as a way to selectively identify commercially attractive innovations developed by users (von Hippel 1986). The method has been used, for example, in the following areas of operation: construction, electronic home banking services, information technology, sports-related communities and products, and kite surfing (Ozer 2009).

The basic idea of the method is to systematically identify lead users and to learn from them. The lead user method is designed to collect information about both needs and solutions from the leading users, leading edges of a company's target market and from markets that face similar problems in a more extreme form. This method is based on two major findings by innovation researchers: 1) Many commercially important products are initially thought of and even prototyped by users rather than manufactures, 2) Such products tend to be developed by "lead users" - companies, organizations, or individuals - that are well ahead of market trends and have needs that go far beyond those of the average user. Although this method is developed for the private sector, it is applicable also in the public sector, where we can also find early adopters and forerunners (see Ling 2002).

By the mid-1990s, 3M's top managers were concerned about the fact that too much of the company's growth was coming from changes to existing products. There were too few breakthrough products. In 1996 the 3M resorted to lead user process/method (LU), which is designed to make the generation of breakthrough strategies, products and services systematic. The case describes an implementation process of LU method in 3M. The role of the university was in this case to participate in the development of the lead user method and in the training 3M's development expert to use this method. (von Hippel et al. 1999; Olson & Bakke 2004).

The lead user process/method has five steps, which are represented in Table 4. In this table short descriptions of the five steps of LU process carried out in 3M are also presented.

Table 4. Five steps of the lead user method/process.

Step 1 – Planning the project
The major goal of this step is the identification of product and market areas to focus product development efforts on. In addition, the identification and recruiting of the key stakeholders from various functional areas within the firm for the LU working team is done. The step is completed with a detailed project plan that includes goals for the innovation and a project kick-off. During the earliest stage of their LU project, the 3M team identified the kind of markets they want to target, as well as the type and level of innovations desired by the stakeholders within the company. 3M's initial goal was to "Find a better type of disposable surgical draping". The development group spent the first month and a half of the project learning more about cause and prevention of infections by researching the literature and by interviewing experts in the field. They then held a workshop with management in which they discussed all that they had learned and set parameters for acceptable types of breakthrough products.
Step 2 – Determine key trend(s)
The goal of the step 2 was to identify and thoroughly research the market and technological trends effecting development in the chosen product and market area. This process involved the identification and interviewing of experts inside and outside the firm that have expertise in the area of interest. Once the trends have been identified and researched, the LU team must prioritize them based on their likely new product development impact, and choose the one or more trends that will be the focus of Lead User recruiting. 3M moved to the trend identification stage by interviewing experts who had a broad view of emerging technologies and leading-edge applications in the area of important trends in the infection control. While the experts they talked to were very knowledgeable about the latest technology advances, they did not prove to have much understanding of the needs of medical professionals in developing countries where infectious diseases are major killers, due in part to the lack of available funding for western style technology. To remedy this problem, the LU team travelled to hospitals in Malaysia, Indonesia, Korea and India to learn how surgeons combat infections where disposable drapes and other more expensive asepsis measures are not widely available. The team realized that even if 3M could radically cut the costs of surgical drapes, most hospitals in developing countries simply would not be able to afford them. These insights led the team to redefine their goal as finding a much cheaper, much more effective way of preventing infections from starting or spreading that did not depend on antibiotics or surgical drapes.
Step 3 – Identify Lead Users
Step 3 used a networking process to identify likely sources of the Lead Users inside and outside the market under study. The contacting and qualifying of Lead Users and preliminary interviews followed this. For the 3M LU team, seeing the needs of medical professionals in developing countries caused the networking process to change its focus from the high-tech arenas to those with extreme needs in both fighting infection and cutting costs. As it is often the case, some of the most valuable Lead Users turned up in surprising places. For example, the team learned that specialists in some leading veterinary hospitals were able to keep infection rates very low despite facing difficult conditions and cost constraints. Another surprising source of ideas was Hollywood. One of the team members learned that make-up artists are experts in applying materials to skin that are non-irritating and easy to remove when no longer needed. These attributes were very important in the design of infection control materials applied to the skin.
Step 4 – Development of innovative ideas and product concepts
This step included workshops involving the recruited Lead Users and the LU team to further develop, refine, and test ideas and concepts developed by the Lead Users. Finished concepts were then prioritized based on technical feasibility and management priorities.

Step 4 – continues
3M LU team invited several Lead Users to a two-and-a-half-day workshop. They all signed over to 3M any property rights that might result from the workshop. The participants met for several hours at a time in small groups. At the end, the workshop generated concepts for six new product lines and a radical new general approach to the infection control. The 3M LU team chose three product line concepts that they felt were the strongest to be presented to senior management. One key factor in choosing the three concepts was that they could all utilize existing 3M technology. Although only one of the three would actually be considered a breakthrough concept, all three ideas also had significant advantages over existing products on important product attributes such as lower costs, increased convenience, and improved infection prevention. The breakthrough product concept was for an "armour" anti-bacterial coating that could be used on medical instruments allowing 3M to enter the \$2 billion market aimed at controlling blood-borne, urinary tract and respiratory infections.
Step 5 – Concept testing
Testing of approved Lead User generated new product concepts on typical customers to determine "current" market acceptance. After further testing with the potential customer demand, the 3M LU team prepared a report on all three concepts with details on their likely acceptance by customers and projected financial returns. The report was presented to the top management and an approval was given to develop the concepts into a physical product. At this point the LU team was disbanded, although one member remained behind to guide the development process through to market launch so that the rich body of knowledge that was collected during the LU process could have a direct impact on the remaining steps of product development and marketing.

4.2. Involving ordinary users

Target organization	Telecom company in Sweden
Date	2001
What is presented here	Method for involving ordinary users in the development of telecom services.
What can we learn from this case	Where the former case was based on lead user involvement, this case illustrates working with 'ordinary users', consumers, in order to get ideas for new telecom services.

Lead and expert users are not always the right target group for organizations pursuing better products and services. For example, if the new products and services are targeted to ordinary users, it could be better to involve them instead of expert users, because the needs of the experts can differ even quite substantially from the needs of the ordinary users. Here were present a user involvement method, which is designed for ordinary users.

To come up with useful services, several companies in wireless telecommunications have begun to involve potential users in the innovation process during recent years. In 2001 an experiment was carried out in Sweden. It lasted 12 days and during this period three groups were given the assignment of generating useful ideas for new SMS-based services. SMS is the acronym for short message service, a technology for sending and receiving text messages via mobile phones. The goals of this experiment was to find out whether consumers can give valuable ideas for new end user telecom services, and how consumers can be involved in generating ideas for new end user telecom services. The actual experiment consisted of the following four stages which are presented in Table 5. This experiment contains an approved method for involving ordinary users in mobile service development. Also in this case the role of the university was to participate in the

development of the method for involving ordinary users. (Magnusson et al. 2003; Kristensson et al. 2004)

One important lesson, which can be learnt from this experiment, is that it is not enough to merely ask the customers, if they have any ideas. If, during this study, the users had been merely asked to come up with new ideas, the result would probably have been ideas already known to or variants of services already implemented. This is what seems to be the normal procedure, when users are asked about their needs in, for example, interviews or surveys. Customers only know what they have experienced, and have trouble imagining the use of emerging technologies. In this experiment the users were activated into problem solving in their own day-to-day environments, bringing newly acquired knowledge of mobile phone technology with them. The users were encouraged to discover new, and as yet unknown, needs; these needs would probably not have been discovered during a traditional inquiry process. This experiment therefore demonstrated that it is not enough just to involve ordinary users, it is also important, how you do this. Besides the firms developing products and services for ordinary users, this lesson is useful also to public authorities developing public services for citizens (Magnusson et al. 2003; Kristensson et al. 2004).

Table 5. Method of involving ordinary users in mobile service development (Magnusson et al. 2003; Kristensson et al. 2004).

a) Start-up phase
In the start-up phase, participants were provided with information on the project and on the scope of the study. To give the participants a sense of how these services worked and to provide inspiration, a number of new mobile phone services already implemented were shown, and the application platform (US) for the study was demonstrated. The task was handed out to participants in written and verbal form. All of the ordinary user participants were presented with the task of creating service ideas that would generate added value for them. All participants received hands-on training on how to use the phone by testing the sample services.
b) Idea creation phase
The idea creation phase of the experiment lasted for 12 days. During this period, participants were expected to create ideas for new mobile telephone services and to log them in their diary. One of the user groups consisting of 4 to 5 persons, met a professional service designer for consultation for a period of 1 to 2 hours, whereas the other groups were able to manage the creation process without assistance.
c) Delivery phase
When the idea generation period was concluded, all participants were asked to transcribe their ideas from the diary into a more detailed service description. After that each group was gathered, and the ideas were delivered. Because the resulting service ideas were aimed at the same target group, they could be compared and ranked against each other, thus enabling the determination of the users' contributions when involving them in the idea creation process.
d) Evaluation phase
The Consensual Assessment Technique (CAT) developed by Amabile and colleagues was used for the evaluation phase. Six experts, experienced in evaluating mobile communications service ideas, constituted the panel of judges. The ideas were ranked on a scale of 10. For the three dimensions used (i.e., originality, user value, and producibility), a score of 1 represented the least original, least valuable, and hardest to produce. Similarly, a score of 10 corresponded to the most original, most valuable, and easiest to produce.

4.3. Involving online user communities

Target organization	Dell company in USA
Date	2007
What is presented here	Method for involving online user communities in product/service development
What can we learn from this case	This case presents, firstly, an approved and successful case and method for involving user communities in the product development of a firm, and secondly, some important lessons learnt from this type of user involvement.

A growing number of firms are trying to utilize online user communities in their R&D&I activities (e.g. Audi, BMW, Lego, Sun Microsystems). Interaction with user communities is also used for other purposes, for example, for recruiting and for enhancing customer loyalty. User communities generally consist of individuals or firms interconnected by information transfer links that may involve face-to-face, electronic, or other communication. While user innovation communities are not a new phenomenon, advances in information and communication technologies (ICTs) have enabled end users of an organization's products and services to organize and share innovations through the creation of online communities (Harhoff & Mayhofer 2010).

On February 16, 2007, Dell invited end users to share their ideas and collaborate with Dell to create or modify new products and services through an online community — Dell IdeaStorm (www. dellideastorm.com). With the launch of this website, Dell created a user innovation community where end users freely reveal innovative ideas with community members and Dell. Through IdeaStorm, end users contribute their business ideas to be reviewed, discussed, and voted upon by the user community. In the first four months of operation, Dell adopted 11 ideas from a wide variety of areas, ranging from pre-installed Linux operating system to the introduction of a new Tablet PC. On April 2010, nearly 14 000 ideas had been posted and Dell has implemented 410 ideas. Some have called IdeaStorm an updated suggestion box. The IdeaStorm has been considered as one of the few cases in which a company has successfully managed to harness an online user community in the company's R&D&I –activities (Di Gangi & Wasko 2009).

The role of the university was in this case, firstly, to assess the IdeaStorm, the method of creating a user community and involving it in the product development, and secondly, to produce information which could be used for the development of this method (Di Gangi & Wasko 2009).

A short description of how Dell's IdeaStorm works is presented in Table 6. Some important lessons learnt by Dell in involving online user communities in firm's product development are presented in Table 7.

Table 6. Description of the IdeaStorm (Di Gangi & Wasko 2009).

1.	To participate, end users create usernames and post their innovative ideas about how Dell can improve existing products and services and/or create new products and services. End users can also post comments about an idea, promote or demote posted ideas (vote) and edit their own ideas.
2.	When a user submits an idea, he or she provides a title and a description. Additionally, the user has the option to classify the idea from over thirty categories (e.g., Linux, Desktops, and Sales Strategies).
3.	Once posted, other end users are able to promote or demote the idea based upon whether they feel it should be adopted by Dell. When users promote an idea, points are awarded and ideas with more points are given special status in the community by the label "most popular status", which is shown on the front page of IdeaStorm.
4.	Demoted ideas or ideas that are no longer receiving votes are automatically pulled from the popular ideas page after a specified period of time, determined by Dell. Each idea submitted to the IdeaStorm website is used as an indicator of an innovation with the potential for adoption.
5.	IdeaStorm uses an Ideas in Action page, which lists and describes all the ideas submitted by the community that have been, or are being implemented.

Table 7. Lessons learnt from involving online user communities in firm's product development (Di Gangi & Wasko 2009).

Benefits for delegating authority to user community
Through discussion forums and user surveys the community of users may try to have a bearing on what kind of innovations a firm should make into its product. Dell IdeaStorm case demonstrated that a firm exploiting user innovation communities in its innovation activities must delegate some authority to the user community. While reducing organizational decision-making power may reduce the level of ownership and control an organization possesses of selecting which innovations to adopt, there are several benefits from delegating some authority to the user innovation community. In the case of Dell IdeaStorm, Dell was able to capture further innovative ideas for the implementation phase of the idea; such as marketing plans and support mechanisms. Furthermore, because ownership of the idea originated within the community, several community members assumed responsibility for resolving potential issues that might arise from adopting such an innovation.
How the user community can make the organization to steal their idea
The members of the user community should learn how they can affect the decision making of a firm. Community's ability to apply pressure on an organization is based on both the clear description of the idea's requirements (i.e., their ability to reduce the complexity of user concerns) and appropriately applied pressure based on the popularity of the idea within the site (i.e., change agent promotion efforts). If users want an organization to "steal their idea", the community must be able to articulate their needs precisely and come to a consensus quickly.
How organizations should respond to user community ideas
Organizations should carefully consider how they acknowledge and interact with user innovation communities. It is important to show that the ideas presented by a user community are respected and taken seriously into consideration by the firm exploiting these ideas. The firm should
• respond to the ideas presented by a user community quickly enough
• to withstand the intensity of the community's demands
• to have enough absorptive capacity to successfully incorporate the ideas presented within its boundaries.

4.4. Involving citizens in the development of public sector

Target organization	Public administration and service sector in the Netherlands
Date	2009
What is presented here	Citizen involvement method in relation to the development of e-Government services
What can we learn from this case	How the citizens can be successfully involved in the development of e-Government services.

Besides developing commercial products and services of firms, Quadruple Helix type of innovation activities and user involvement methods can also be used for developing public services. A good example case for this kind of activity is provided by van Velsen et al. (2009). Governments and political bodies across the globe are exploring the potential benefits of ICT for improving communication with citizens and stimulating participation and engagement in political and civic processes. These initiatives are often referred to as e-Government. The primary delivery method for e-government is the internet, which could be used, for example, to voting electronically in local and national elections, and to the engagement of citizens in consultation and community planning. Several authors have argued that in order to achieve the e-government goals of increasing citizen participation and improved speed and efficiency of the underlying processes, a participative approach to the design and delivery of e-government is required.

van Velsen et al. (2009) argue that throughout the last decade, user involvement in e-Government service design has been virtually nonexistent. Over time, e-Government experts have begun to realize that these services would benefit from a citizen-centric requirements engineering approach. This has led to a demand for such an approach for this particular field. However, the actual e-services that government agencies have provided in the last few years have fallen short of being citizen-centric due to a lack of representative user involvement in the design process. In order to design high quality e-Government services that comply with the needs and wishes of the citizens, a user-centered design approach needs to be developed within this context. In addition, e-Government services not only have to match the needs of the citizens for whom they are intended, but should also correspond to the needs and work practices of the civil servants who provide and deliver the service in question (van Velsen et al. 2009).

In Table 8 a method for involving citizens and civil servants in developing e-Government services is presented. The approach utilizes interviews, the formulation of requirements with a focus on concrete and measurable criteria, low-fidelity prototyping, and an evaluation by means of a citizen walkthrough. This method is based on the B-dossier project (http://b-dossier.telin.nl) of Novay, a joint research initiative with partners from government and academia, comprising the Dutch Tax and Customs Administration, the Municipality of The Hague, SVB, UWV, ING, ICTU, the University of Twente, and Delft University of Technology.

Table 8. Method for involving users/citizens and civil servants in the development of e-Government services (van Velsen et al. 2009).

1. Citizen and civil servant interviews
For the elicitation of user requirements for e-Government services it is wise to consult stakeholders with previous and direct experience of the service in question. Two stakeholders comply most with this profile: citizens who recently applied for the service, and civil servants who are directly confronted with the service's applicants. Recommended conversation topics of citizen interviews: – Client demographics (age, housing situation, disabilities, etc.); – Critical incidents that determine (dis)satisfaction with either the application process or with how the application is managed, as experienced by the client; – The chronological service application process, as experienced by the client; – Expectations of digitalization of the service application and management processes. Recommended conversation topics of civil servants' interviews: – Typical client questions or situations and their translation into actual service; – The information required of the client; – Different organizations in the service supply chain: their role, information exchange processes and trust in the quality of information, supplied by others; – Expectations of digitalization of the service application and management processes.
2. Interview analysis
In order to generate input for the requirements' formulation stage, the transcribed interviews need to be analyzed. Below three relevant systematic analysis techniques are represented. Combined, they provide the requirements engineer with an overview of the critical issues that an e-Service needs to take into account, the decisions citizens and civil servants feel they have to make and that need to be facilitated, and finally, the relevant human factors. a) *Critical factors analysis*. This analysis technique focuses on uncovering the factors that are critical for citizens to successfully complete a process or make decisions. If addressed in the interview, the analysis can also focus on experiences which citizens deemed critical for their satisfaction with a service. This way, the requirements engineer can identify the kind of information, or the manner in which it is communicated, that is vital for an effective and efficient system. b) *Decision analysis*. By analyzing the service process, as experienced by citizens, and focusing on the decisions they made, an overview of the information that needs to be provided to the citizens, and at what moment, can be constructed. In order to do so, one first has to identify the (important) decisions in each process, identify the steps involved and, finally, the information that the citizen needed here. c) *Human factors analysis*. This last analysis method concerns the search for issues that may hinder successful interaction between the user and the system. By taking the resulting human factors into account as user requirements in the system design, a greater fit between the system, the needs and the wishes of the user, and the context can be achieved.

Table 8. Continues.

3. User requirements notation

Every critical factor, step in the decision process, or human factor that should be taken into account in the e-Service design, should be formulated as a user requirement. Several formats for the documentation of requirements are available. Here the Volere method is presented. Several features make this format superior to others in a user-cantered design process.

1) The rationale behind each and every requirement needs to be written down. This will function as anecdotal evidence for the designers and, in this respect, increase the likelihood that the requirement will be implemented in the system design.

2) A fit criterion must be formed, which specifies how the successful implementation of a requirement in (a prototypical version of) the e-Service design will be assessed, preferably by means of user evaluation. This fit criterion not only establishes the quality of the (prototypical) e-Service design, but can also determine the return on investment.

3) Next an estimation of customer satisfaction is done, in which it is estimated whether customer satisfaction is increased or decreased as a result of taking the requirement into account or not. This estimation serves as an input to determine the requirements in order of priority, and shows which user requirements should at least be taken into account in the final e-Service design.

4. Low-fidelity prototyping

Now that we have an initial set of user requirements, their relevance for stakeholders and the form in which they are to be implemented in the e-Service, interface and interaction design must be evaluated. We propose a strategy that uses citizen walkthroughs, facilitated by a low-fidelity prototype and a fictive scenario. This strategy is inexpensive and easy to set up and conduct.

A low-fidelity prototype can take the form of a set of pictures, displaying the main screens and functionality of a system. It does not have to be representative of the final system and can be made in programs like Photoshop. Low-fidelity prototypes enable designers to quickly and inexpensively visualize the functionality and 'look and feel' of a future system, but limits the possibilities of showing the navigation within a system. The use of such a prototype has been found to be a fine trigger of user feedback and because screenshots do not resemble a finished system in which a lot of time and effort has been invested, evaluation participants are less reluctant to provide negative feedback. Ultimately, the evaluation of a low-fidelity prototype will inform the requirements engineer, whether he or she has missed some important user requirements, and whether the visualized requirements are valid or not.

5. Citizen walkthroughs

During a citizen walkthrough, a participant is shown the low-fidelity prototype version of the e-Service and is asked to provide comments on the functionality, the interface and the interaction design. When confronted with important functions or steps in the service process, participants can be explicitly questioned about their opinion. These questions are to be drafted before conducting the sessions and should be posed to each participant at the same time during the walkthrough. Traditionally, these sessions are conducted with experts, but they can be held with regular users (citizens) as well.

We advocate a citizen walkthrough set-up in which a low-fidelity prototype, with a limited set of screenshots (approximately 15), is presented by means of a persona. At the end of each screenshot the participant is to be asked about his or her impression of the screenshot, the completeness of the information provided, and the functionality displayed. At the end of the walkthrough, the citizen can be questioned about abstract issues such as trust, control and barriers to using the e-Service. Through this set-up, the issues of catering for a heterogeneous user group, incidental use, complicated content and interoperability are all accounted for.

Table 8. Continues.

6. Citizen walkthrough analysis	
The citizen walkthroughs will result in a large amount of transcribed text. In order to generate meaningful results from these transcriptions, a systematic analysis approach is required. We present four analysis approaches. a) *Process analysis*. This approach focuses on the user's overall perception of the e-Service process as well as the different steps contained within it. b) *Functional analysis*. This approach focuses on the typical features of the e-Service, derived from the user requirements. c) *Question analysis*. This approach focuses on citizens' responses to questions, related to specific screenshots or functionality, posed during the walkthrough. d) *Sensitizing concept analysis*. This approach focuses on concepts that are not interface-specific, such as trust in the system or the intention to use it.	
7. Review of the initial user requirements	
After the citizen walkthrough, one will have to review, and possibly revise, the initial user requirements, as some will prove not to be as important as expected or will not be accepted by the citizens. When the requirements document is complete, one can start designing and programming the e-Service, which, according to user-cantered design principles, should also be tested with prospective users.	

4.5. Halmstad Living Lab

Target organization	Halmstad living lab in Halmstad University in Sweden
Date	2007-2009
What is presented here	Experiences of a living lab from the perspective of SMEs
What can we learn from this case	This case gives you some detailed learning lessons of building user involvement with focus on small enterprise partners. From this case you can learn, firstly, about the challenges small enterprises face when they participate in living lab activities, and secondly, about the things SMEs should take into consideration when they are trying to exploit users in their R&D&I activities.

Halmstad Living Lab was established in 2007 and is situated in City of Halmstad, Sweden. The host of the LL is the Halmstad University. Halmstad Living Lab works within the application area of health technology and media with a specific focus on small enterprise partners. In 2009 around 500 users have been involved in face to face activities and over 7000 users in online surveys. The partners of the Halmstad Living Lab related to health technology include Halmstad municipality, the Healthcare Technology Alliance, and several senior citizens and next of kin organizations. Furthermore, the Halmstad Living Lab has a network of small enterprises working within the health technology field. In the living lab projects related to media technology firms, newspaper organizations, advertisers and universities across Europe have participated.

The focus of the living lab is to enhance innovation processes of the companies as well as to provide value adding IT innovations to the consumer. Currently the living lab has four research-funded projects of which three involves users together with SMEs that are creating and validating products and services aimed at supporting and empowering elderly people. The fourth project is within the media sector, where researchers, 7 newspapers and readers are exploring the challenges

of user-generated content with a living lab approach. Examples of the products and services developed in the living lab are special lock and alarm product and service for elderly people living in their homes, digital newspaper and ubiquitous media services. Users have participated in the idea, development and test phases of the innovation process, and the degree of the user involvement can be characterized as design for and with the users (Svensson et al. 2010, Eriksson & Svensson 2009, Svensson & Eriksson 2009).

The production of commercially successful innovations is a challenging task, especially for small enterprises. They often lack the resources and knowledge that large organizations have about, for example, technological R&D, marketing and information on new trends in the society and on the users/consumers. One way of strengthening the SMEs' innovation capacity is to collaborate with other actors such as academia, the public sector and other enterprises. In Halmstad Living Lab SMEs have participated in this kind of a broad innovation co-operation, and they have met several challenges and important issues to consider related to the operations in the living lab. We have gathered some important challenges and lessons learnt by them in the Table 9.

Table 9. Important lessons learnt by SMEs in Halmstad Living Lab.

I From a small enterprise perspective four challenges that need to be addressed in living lab activities (Svensson & Eriksson 2009):
1. *In what way can living lab activities contribute to expanding the competencies within small enterprises?* It is important to provide the enterprises with the knowledge that enables them to perform user involvement activities of their own, but as for most small enterprises the time is pressured it is important to provide assistance from the living lab when needed. It is good to have at least one enterprise representative present in the living lab activities, so that they could learn how to perform different activities themselves.
2. *How to create openness between enterprises and other stakeholders regarding legal documents such as IPR and patent?* This is one of the most challenging tasks within the living lab. It is important to create an open positive arena that is based on trust, both between different enterprises and between enterprises and researchers as well as users. Competence within the legal area is needed and should be available within the living lab.
3. *How can the business model aspects be incorporated early in the innovation process to involve all stakeholders?* To have a successful innovation that is being adopted by many, it is of vital importance to secure the business model early in the innovation process. In the health technology application area there is a problem due to a strict public procurement procedure of the hospitals and the municipalities. However, through involving the end users other business model opportunities could emerge by identifying products and services that they themselves would be willing to pay for. After each activity possible business model opportunities should be discussed with the enterprises to be able to follow up on this subject in forthcoming activities.
4. *How can small enterprises be stimulated to work more consume- oriented, to involve the end users in the innovation process?* The researchers in the living lab are of vital importance in the initiation of user involvement activities. The small enterprises in living labs often consist of engineers without experiences of methods and tools for user involvement. A good way of starting is within research projects, when the researchers can plan and carry through the activities with the users. By involving representatives from the enterprise to observe and later on be more active in these activities, the enterprises can get hands-on experience of both the benefits of the outcome and of how to carry out such an activity.

Table 9. Continues.

II Regarding different kinds of user contribution there are three important issues to consider in a living lab (Svensson et al. 2010):
1. *Required output.* It is important to consider which type of output is needed in the different phases to secure the right kind of user contribution. This is also dependent on the degree of user involvement in the innovation process, e.g. activities performed "by users" results in another type of output than activities "for users". 2. *Resources needed.* Different methods and techniques require different resources. It is important to take into account the resources needed to gather, analyze and summarize the provided input. For example, face to face activities are very resource demanding. 3. *Facilitator role.* The facilitator role is very important especially in the creation of contribution activities, where the facilitator must be able to balance between dominant users that have a tendency of getting their point through more often than their more quiet and conservative counterparts.
III Four important issues that need to be addressed regarding different types of users in a living lab (Svensson et al. 2010):
1. *Composition of user group.* There is a need to consider the composition of the user group from three perspectives. First, the relation to the system, i.e. identifying primary, secondary and tertiary users. Second, the competence to aid the innovation process, i.e. to consider users' different levels of knowledge. Finally, the representation of the intended target group regarding gender, age, computer skills etc. 2. *Different perspectives on innovation.* There is also a need to reflect on different perspectives of the innovation at hand. The involvement of these perspectives is a way to ensure that different user groups' needs, wants and requirements are identified. Also, by acknowledging different views of value and motives for use, and working with these differences in the innovation process, the innovation is more likely to be considered usable from a broad range of users. This also supports identification of new ideas and unexpected business openings. 3. *Conflicting interests.* They need to be handled within the user group. In many ways, encouraging these to emerge and to be discussed improves the dynamics of the group and often leads to a better result at the end. 4. *Identifying dedicated users (motivation).* It is important to have dedicated users taking part in the workshops. To get satisfying results from an activity the users have to be interested and dedicated to the cause.

4.6. Sekhukhune Living Lab

Target organization	Sekhukhune living lab in South Africa
Date	2008-2009
What is presented here	Different evolutionary phases related to the construction of a living lab and concrete methods needed in these different development phases
What can we learn from this case	This case gives and overview of the evolution, different stages and critical phases of creating a collaboration and experimentation environment with micro enterprises. Case also gives an example of R&D&I methods and tools needed in different stages of living labs' evolution.

Sekhukhune Living Lab is situated in South Africa, Sekhukhune District in the Limpopo province. Living lab has evolved through C@R (Collaboration@Rural) project, which was an EU funded Integrated Project as part of FP6 and aims to boost the introduction of Collaborative Working Environments (CWE) as key enablers catalyzing rural development. C@R addresses rural living

labs. It aims to develop and experiment a collaborative platform for enhancing working and living in rural areas, characterized by difficult but challenging social, economic and infrastructural conditions. The basic idea of Sekhukhune Living Lab is to develop services and applications (incl. GIS procurement application) which support the development and growth of local SMEs (Friedland et al. 2008; Mertz et al. 2009).

The overall vision of the Sekhukhune Living Lab interventions is to create an impact on operational excellence of small and micro enterprises specifically with regard to:
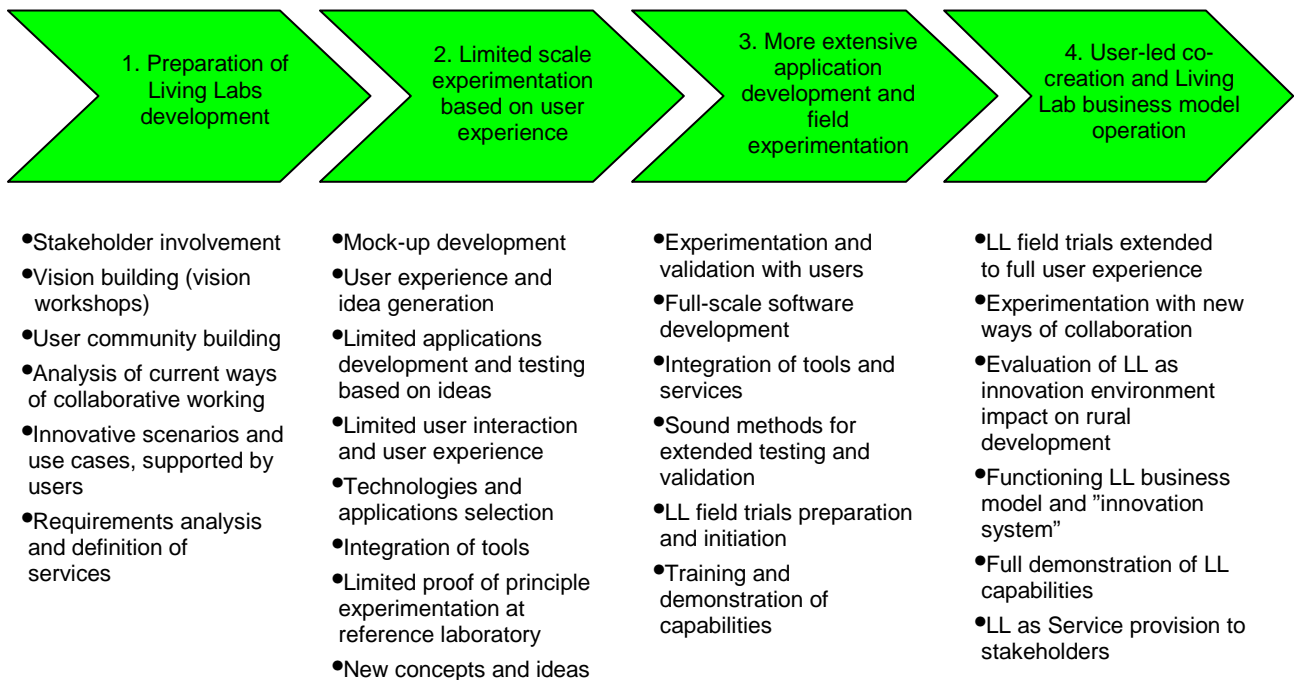
- the establishment of economies of scale to overcome the problem of the critical size,
- the bridging of gaps between players of the informal and formal economy supporting accessibility of profitable markets,
- the reduction of transactional costs caused by remoteness, bad infrastructure and limited resources, and
- the employment of entrepreneurs providing ICT services that have not been accessible in rural areas so far (Infopreneur concept, developed by CSIR / Meraka).

The Sekhukhune living lab approach to user engagement is characterized by marrying the so-called 'System of Innovation' (SOI) and the 'Community of Practitioners'. The 'community of practitioners' consist of a micro-franchise network of social entrepreneurs - called Infopreneurs. These rural "social" entrepreneurs run start-up service enterprises at different levels of complexity and size (hubs, nodes and satellites) within the local communities of Sekhukhune. The SOI consists of a number of institutional actors that carry out different, mainly research and technological development functions at different 'distances' from the "community of practitioners". Implementation of the rural living lab approaches is supported through a tight cooperation between CSIR/Meraka institute and SAP Research. This partnership leverages know-how about African business processes with the best practices in software engineering also reflecting the expertise of a consortium of further European technology providers.

This case brings forward the concrete methods needed in different development phases of living labs. In Figure 7 we can see the different evolutionary phases of Sekhukhune Living Lab and the activities and methods used in each stage.

Figure 7. The different stages of living lab evolution (Friedland et al 2008).

1. Preparation of Living Labs development	2. Limited scale experimentation based on user experience	3. More extensive application development and field experimentation	4. User-led co-creation and Living Lab business model operation
•Stakeholder involvement	•Mock-up development	•Experimentation and validation with users	•LL field trials extended to full user experience
•Vision building (vision workshops)	•User experience and idea generation	•Full-scale software development	•Experimentation with new ways of collaboration
•User community building	•Limited applications development and testing based on ideas	•Integration of tools and services	•Evaluation of LL as innovation environment impact on rural development
•Analysis of current ways of collaborative working	•Limited user interaction and user experience	•Sound methods for extended testing and validation	•Functioning LL business model and "innovation system"
•Innovative scenarios and use cases, supported by users	•Technologies and applications selection	•LL field trials preparation and initiation	•Full demonstration of LL capabilities
•Requirements analysis and definition of services	•Integration of tools	•Training and demonstration of capabilities	•LL as Service provision to stakeholders
	•Limited proof of principle experimentation at reference laboratory		
	•New concepts and ideas		

According to Friedland et al. (2008) moving forward through these different development phases necessitates a spiral development approach, which includes the following steps of action research:

1. Establishing various agreements among participants through an extended negotiation process and building long-term established relationships amongst the different stakeholders (incl. the local communities).
2. Diagnosing the issues and challenges, doing interpretation and data collection leads to theoretical assumptions. In the case of Sekhukhune this step has been clearly driven by the end users.
3. Action planning: specifying improvements and interventions, action plans, experimentations.
4. Action taking: implementing changes, carrying out experiments, continuous monitoring, and feedback to participants.
5. Evaluating: collaborative evaluation of outcomes, problem redefinition.
6. Specifying learning.

4.7. Living Lab implementation guidelines

Target organization	Persons and organizations interested in the implementation of a living lab concept
Date	2009
What is presented here	Guidelines for implementing a living lab type of innovation environment
What can we learn from this case	This is a summary containing a wealth of experience of working with SMEs and gives a set of guidelines of establishing an user involvement environment enabling systematic user involvement.

Living labs could be seen as a systematic way of involving users in the innovation activities of private and public organizations. Santoro and Conte (2009) have formulated guidelines for implementing a Living lab. These guidelines are based on the work done by a number of 6th FP RTD projects in the ICT domain as well as on the experience collected from the various living labs in Europe within the CO-LLABS Thematic network. This implementation recipe is believed to be suitable for many different contexts and it contains the essential ingredients of a living lab (Santoro & Conte 2009).

The construction of a living lab consists of two main phases: a) Living lab set-up and b) living lab operations. The set-up of a living lab in a regional context implies the capability of establishing the main mission objectives of the Public Private Partnerships, the identification of the main stakeholders active in the regions in the specific domain and sectors, and the overall collaborative scenario for linking the various groups in an effective and optimized way. In operation phase, the objective is to establish a so-called "Innovation Vortex", through which the product and/or service is finalized as a concept, developed in the living lab context, deployed for a reality check trial and evolved on the basis of the user feedback collected from the various living lab stakeholders. A more detailed description of these two phases is given in Tables 10 and 11 (Santoro & Conte 2009).

Table 10. Living Lab set-up phase.

Living lab set-up
1. Establishment of the community of service/technology developers, in charge of designing and making available innovative products and services to be tested within the Living Lab environment.
2. Establishment of the community of public/social stakeholders, which are the originators of the Living Lab in that region, with a view of generating economic value from the service/product ideas under trial, of providing better/added value services to the users and exploiters and of showing returns for the invested money.
3. Establishment of a community of professionals (from academia, public administration, industry and consultants), willing to provide advice and support to the definition and experimentation of the proposed service/products when available.

4. Establishment of a community of users, willing to experiment and utilize the provided product and services, possibly grouped according to the specific interests and use intentions:
    o   the final users of the proposed product and service (for instances, consumers, residents, students, citizens, associations, enterprises);
    o   the organizations, which will make them available to the public (service providers, public administration, municipality, utilities).

5. Definition of the legal entity representing all the previously mentioned **Living lab actors** and suitable for implementing, updating and maintaining the Living Lab mission.

Table 10. Continues.

6. Set-up of a supporting IT Collaborative platform, suitable for: o *Facilitating the communication* among the various components of the living labs; o *Collecting and framing the trial outcomes* in an objective and usable way; o *Supporting the co-creation processes* among the various living lab groups; o *Providing virtual reality simulation tools* to support the experiencing and sensing of innovative projects. The specific configuration of the IT supporting platform depends upon the domain of applications and services which the living lab is targeting, as well as on the typologies of constituency and expected use scenarios.
7. Identification of a Living Lab performance model, suitable for collecting, assessing and evaluating the performance of the public money invested in the living labs in terms of social outcomes.

Table 11. Living lab operation phase.

Living lab operation
1. Identification of idea development and/or demand creation mechanisms, suitable for providing new ideas to be tested within the living labs. Examples of such mechanisms: o spontaneous proposal from the community of service/technology developers; o request from the user community, which can express a need not yet fulfilled; o Business/Idea competition and awards, in which the regional development agency organizes a competition relevant to innovative business ideas in order to generate new companies and new jobs.
2. Identification of a specific group of service/technology developers, willing to subject a specific product/service to a living lab trial, for either market validation or co-creation/open innovation design purpose;
3. Identification of the living lab trial tutor, in charge of coordinating and facilitating the implementation of the trial inside the living lab;
4. Identification of the living lab trial requirements by the trial tutor, by analyzing the product/service features and interpreting users' expressed needs;
5. Identification of a specific user group by the trial tutor, extracted by the overall user constituency, willing to conduct the experiment activities and to provide feedback;
6. Identification of a Virtual Team of experts by the trial tutor, representative of the disciplines and competencies needed to support the conduction of the trial, in charge of providing suggestions on how to operate the service and/or to adapt it to the practical/real life situations encountered;
7. Establishment of the living lab trial plan, including the preparation of it, the activities to be performed by the various actors and the operational metrics (different from the impact metrics), to be collected to achieve the market validation of the proposed product and services;
8. Set-up of the living lab trial IT environment, specific to support the operation of that specific trial. The living lab trial IT environment provides support for collecting use scenario metrics;
9. Conduction of the living lab trial, under the supervision and coordination of the living lab trial tutor;
10. Results analysis of the living lab trial, by the living lab trial tutor. This can be an iterative process, depending upon the strategy of the specific living lab trial and the level of accuracy of market behaviour prediction required by the service/product developers.

4.8. Finnish Living Labs

Target organization	Finnish living labs
Date	2009
What is presented here	Study of Finnish living labs
What can we learn from this case	This case gives a general overview of the concrete characteristics and development challenges of the Finnish living labs.

Følstad (2008) reviewed living lab literature (32 papers in total) and came into a conclusion that this literature was characterized by a remarkable lack of in-depth descriptions and discussions of living lab processes and of innovative methods for end-user involvement. In addition, he found none of the papers providing critical discussions or investigations of existing living lab processes. This makes it difficult to find out what the living labs are really made of.

One of the few in-depth descriptions of living lab is made by Orava (2009), who conducted a study of the Finnish living labs in 2009. Study is based on a survey in which 25 actors participated in May 2009. The questionnaire was sent to the Finnish organizations and networks which called themselves as living labs. This case gives a very good overview of the concrete characteristics of the Finnish living labs. Although this study is made in the Finnish context, our case study, which includes several living labs illustrated, implies that the results of Orava's study might have wider significance and reflect some of the characteristics typical for living labs also in other countries.

About half of the Finnish living labs in question operated in the area of health and wellbeing, nine in construction and habitation, eight in ICT and media, five in tourism and accommodation, three in the public services. Most of the studied living labs were projects and had a fixed-term project funding. Typical for them was also that they were relatively recently created and they did not yet have permanent operations model and processes. A clear development challenge for the Finnish living labs seems to be how they can secure their continuity and establish their structures and operations.

Majority of the Finnish living labs had also no recognizable leader. They were led by a project manager, a co-ordinator or a facilitator, and guided by a steering group. Orava (2009) argues that in the project type living labs the essential decisions are often made by the financiers. All these living labs were operated by less than ten persons, but the total number of people being part of the living lab network was much higher.

Public sector has a rather strong role in the Finnish living labs. Almost all of them were financed largely by public funding, and majority of them were also public organizations. About one third were both private and public organizations and only two were private organizations. Typical financiers of the Finnish living labs were cities, municipalities and federations of municipalities and TEKES (the Finnish Funding Agency for Technology and Innovation). In most cases the accountable organization was a polytechnic or (regional/local) development corporation. Other typical accountable organizations were universities or some public actors.

What do the living labs actually do? We can have some idea of this by examining the services that the living labs are offering to their clients. Typical services provided by the Finnish living labs were
- project planning and projecting;
- innovation and development services for firms;

- Living lab tools for carrying out case studies;
- environment for piloting and innovating;
- administrative services for projects;
- finance applications;
- supporting servicers for businesses;
- evaluation of usability;
- mapping user needs;
- fast network as a testbed for producers of programmes and equipments;
- online focus group discussions;
- prototyping;
- testing of prototypes;
- evaluation of scenarios;
- use need mapping;
- evaluation of product and service concepts; and
- product development.

Living labs were realized in different operational environments, they were carried out in e.g. neighbourhood, hotel room, campus, living lab tool environment, farms and fields, service-, technology- and innovation centre and web-portal. From this we can conclude that most of the living labs were operating in real environments and only a couple of them were virtual living labs.

One very critical factor for living labs (and for other QH type of innovation environments) is whether they succeed in involving users in their innovation activities. From Table 12 we can see what kind of users the Finnish living labs have managed to involve, which kinds of methods they have used in their user involvement activities, and how they have motivated the users to participate in the development work.

Table 12. Typical characteristics of Finnish living labs related to users and user involvement (Orava 2009).

Examples of different user groups	- adult students - ICT enthusiasts - mobile ICT experts - disabled, persons with mental disorder - senior experts - technophobic elderly - young people being conscious of the technological possibilities - the family carers in health and wellbeing sector
User involvement methods	- active/passive role-playing - ethnographic research - InnoGame method - self documentation/user diary - brainstorming - survey - usability testing - videotaping and analyzing user activities - user observation - individual and group interviews - case studies - statistical analysis

Table 12. Continues.

Methods of motivating user involvement	• appealing to common goals and benefits of user and the LL project • offering free internet connection • offering a possibility to have a concrete effect on the product or service the user him-/herself uses or his/hers fellows use • giving an observable recognition, e.g. in the webpage of a firm, that the user has participated in the development work. • offering a possibility to use a new product or service before other people • arranging regular meetings of users and informing the users of the Living Lab (incl. results of the development work) • paying a reward to the user.

Another special feature of the Finnish living labs was that the innovation activities were often research-driven, in other words, the idea to launch activities or cases came from developers, not from exploiters or users. In other words, the degree of user involvement in the Finnish living labs could be characterized as design for and with users, but not by users.

Finnish living labs were rather closed networks in the sense that they typically functioned as autonomous or separate networks and they had very few international partners. Learning possibilities of the living labs were also hampered by the fact that their activities were inadequately documented. The most urgent development goals and needs recognized by the living labs themselves are presented in Table 13.

Table 13. Development goals and needs of Finnish living labs (Orava 2009).

Development goals	• to network with the regional actors in order to support regional development • to have more functional and better organized co-operation concept • to ensure the funding for recruiting of employees and for the building and maintaining of operational environment • to specialize in a certain field of operation regionally and internationally • to connect the Living Lab activities to part of normal business activities
Development needs	• the most important deficit of special know-how is related to financing and business operations. • In addition, know-how is needed in connection with the exploitation of user-driven methods and experiences gathered using these methods.

Into Table 14 we have gathered some typical challenges confronted by the Finnish living labs. Three of them are general challenges of living labs and the rest are related to certain development phases of the living labs. These challenges are most likely typical for all innovation environments, in which firms, universities, public organizations and users are involved in co-operative innovation activities.

Table 14. Lessons learnt from Finnish living labs (Orava 2009).

General challenges of Finnish living labs
• Different actors use different definitions of living labs, this can complicate the co-operation of these actors.
• How to make firms realize that they should use new development methods and have new development partners (i.e. to change over from a dual or triple model to a Quadruple Helix model).
• Results and benefits are expected too soon.
Challenges related to different development phases of living labs
P*lanning and initial preparation phase*   • definition of the co-operation model of LL,   • creation of a trustful atmosphere among different actors,   • creation of a co-operation network which is broad and versatile enough, and   • to profile LL activities from the viewpoint of actual users which are not yet known in this phase.
Launching phase   • the launching of the first cases when there is not yet approved practices and processes,   • the motivation of different partners to participate equally in the LL activities,   • taking into consideration all different partners and constantly activating them,   • the use of user-driven approaches instead of technology- or researcher-driven approaches, and   • inadequate human and financial resources.
Establishing phase   • keeping up of adequate innovation level, i.e., continuous development, and keeping up adequate level of ordinary user involvement, and   • making LL activities economically viable.

On the basis of these challenges it is easy to conclude that a multi-partner innovation co-operation model like QH is not easy to implement successfully, and that it necessitates a lot of know-how. From Table 15 we can find out the most important lessons the Finnish living labs have learned. In order to avoid unnecessary risks of failure everyone who is carrying out or planning to carry out same kind of innovation activities should take these lessons into consideration.

Table 15. Most important lessons learnt in Finnish living labs (Orava 2009).

Most important lessons learnt
• assess the operational risks, it helps at preparing for different sudden situations and for learning the responsibilities of a living lab actor;
• make a communication strategy, which is actively developed and dismounted into the region and among the users;
• make a clear scheduling for the projects, so that different persons and organizations know their responsibilities and outputs;
• accurately describe the roles of different living lab actors in LL cases, so that everyone knows in which role they are during the cases;
• consider carefully the motivation of user involvement (i.e. how to motivate users in different phases of innovation activities);
• make real time reports of the different phases of the cases through web pages; and
• make a critical evaluation after every case how it went, in order to learn and be better prepared for the next cases.

5. Communicating with the CLIQ partners over QH

The research project has got input from the partners via two ways: (1) A Questionnaire in January-February 2010 on Quadruple Helix actors and activities in the partner regions/local areas, (2) A Case Reader in April 2010 of examples of user involvement in innovation. A short article was also provided for the CLIQ e-Bulletin.

5.1. The Questionnaire on Quadruple Helix

The Questionnaire on QH comprised of questions on
- innovations produced in the area,
- how intensively different actors (firms, research institutions, innovation promoters, the business community, public authorities, users, consumers and citizens) are involved in innovation activities in the respective regions
- who are the most important partners in innovation activities
- examples of innovations produced by user involvement
- the role of users in the example
- role of local/ regional authorities in the example
- possibilities of supporting user involvement (citizens, customers, clients, consumers, employees, hobbyists, students, social media communities, civil society associations…)

There were altogether 20 responses from the CLIQ partners covering the partnership quite well (responses from Jyväskylä, Girona, Catalonia, Manresa, Eskilstuna, Leeuwarden, Gävle, Mikkeli, Ulm, Beira, Cadiz, Pau and Crete). Some partners provided more than one answer. Most respondents were local/regional authority representatives (11), others were innovation experts (5), innovation service providers (2) and innovation project members (2).

In the QH survey it turns out, that on the average the highest intensity actors in innovation activities in the partner regions are big firms, universities and polytechnics, national R&D institutions, science parks and business incubators (see Figure 8). A "mid-range" of involvement contains technology centres, business development centres, public national R&D financers and local and regional authorities. The lowest intensity was with consumers, citizens, and employees.

Figure 8. "How intensively the following actors are now involved in innovation activities in your region/ local area?

CLIQ-partners average in QH-survey
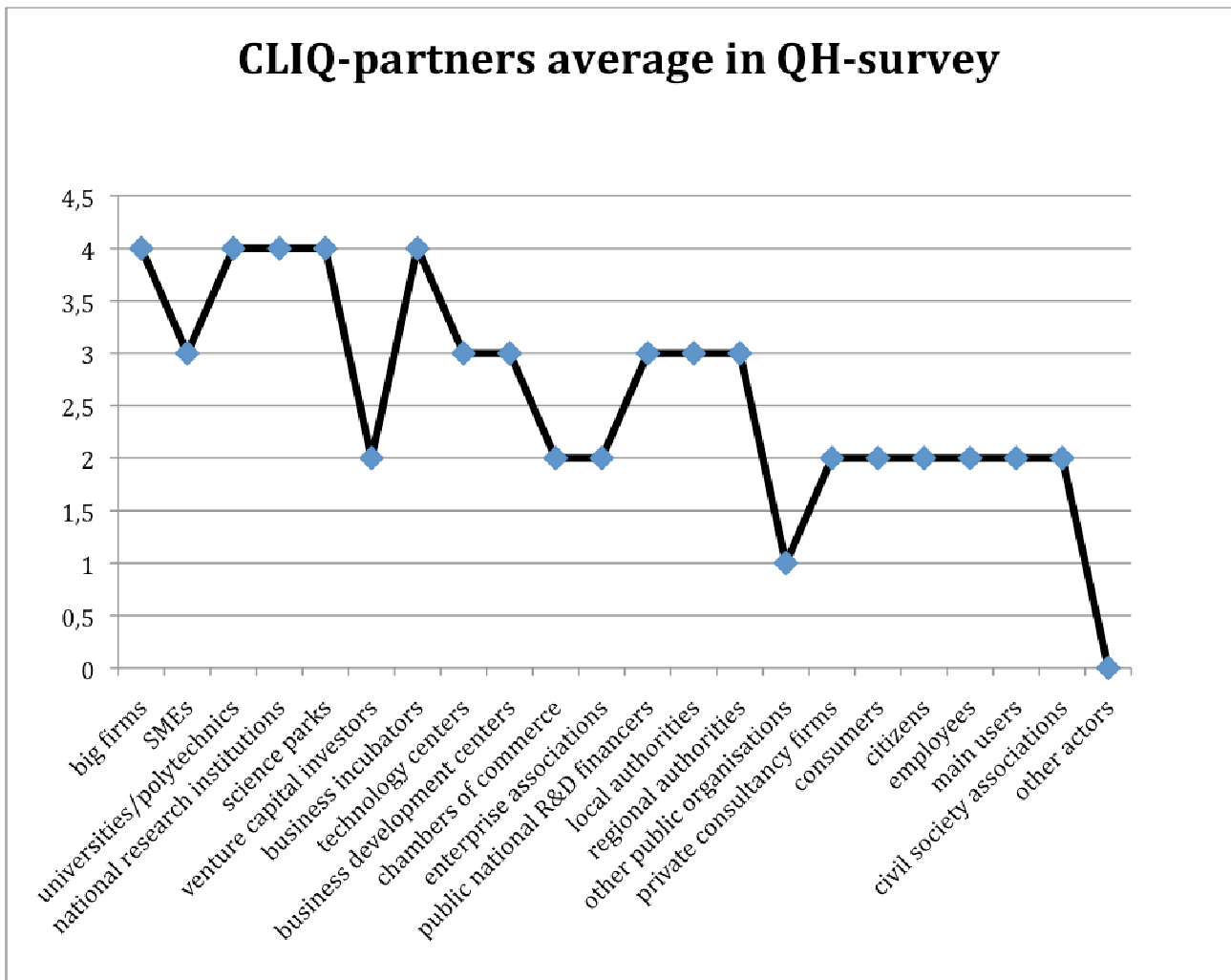
So the overall average of the CLIQ QH survey seems to render a picture of being close to a "TH model". Looking at averages in such a small sample is of course only indicative, and the purpose was to get a quick glimpse of how far the CLIQ partners seem to have moved in a user involvement direction in innovation. There is quite considerable variation among the CLIQ partners concerning this, but we want to leave the reflections of these for the partners themselves against the QH concept analysis, practice examples, overall conclusions and recommendations.

In fact in many regions/cities of the CLIQ partners there is a wealth of examples of different levels of user involvement, also in the light of the Questionnaire answers (Figure 9). They vary from a minor involvement consisting of answering surveys via web forum participation to a high level of involvement in pilot testing, development groups and modifying or creating products. Most mentions about user involvement (14) were participation in pilot testing and user feedback. A simple tally of mentions of types of user involvement by the CLIQ partners in Figure 9 shows the overall numbers of mentions of user involvement.

Figure 9. "What kind of role did users have in your example (on user involvement)?"
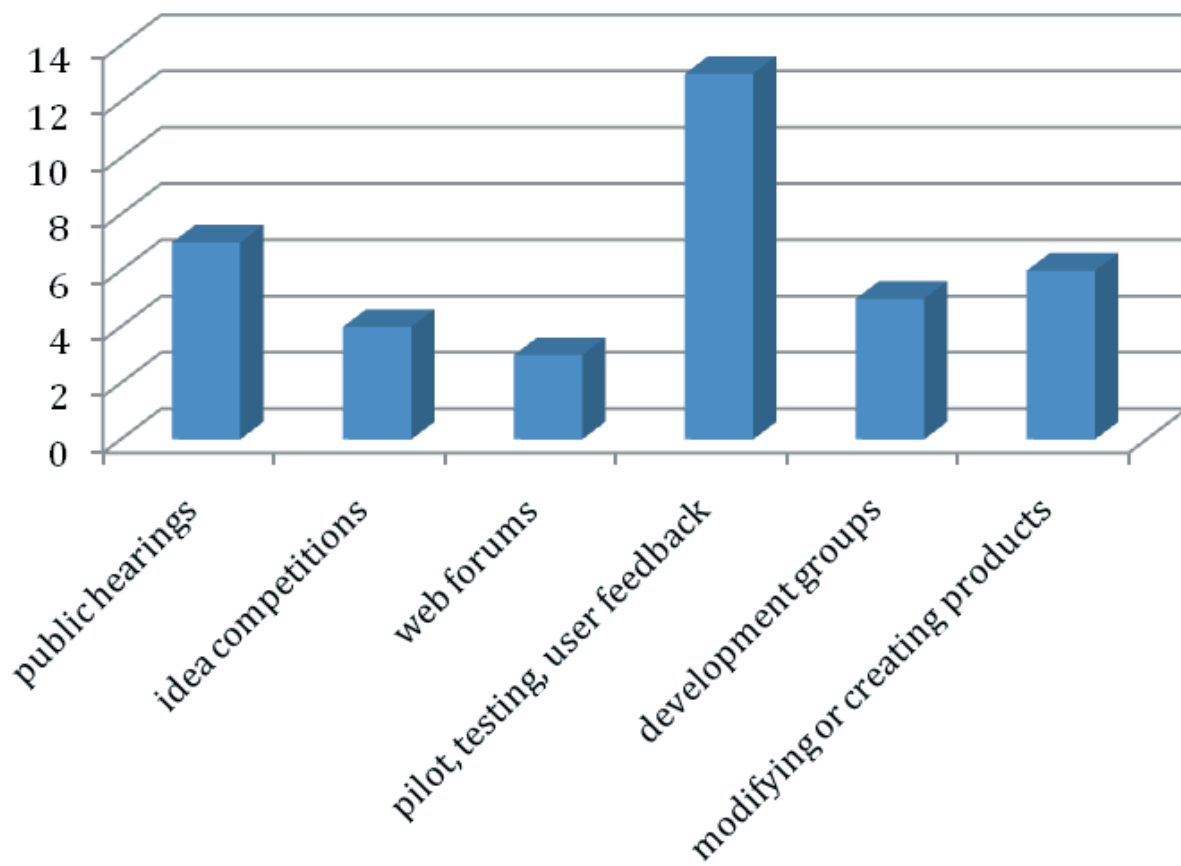
5.2. The Case reader on User Involvement Examples

A Case Reader was circulated in April 2010 among the partners to prompt reflections on QH and user involvement. A few telephone interviews (6 in all) were made instead of or as complementary to the written responses.

The Case Reader on Quadruple Helix for the CLIQ partners was an excerpt of our ongoing search for good examples of QH. The main criteria for the case selection was that the case clearly differentiates itself from Triple Helix type of innovation activity, and that it represents QH type of innovation activities, in which all four QH actor groups are involved and/or innovation activities in which the users have had an essential role. Also an important criterion was that there exists an in-depth and rich enough description of the case.

The Case Reader was by no means conclusive, but intended to work both ways - as a "conversation piece" from and to the ongoing research. It was intended for reflective comments from the partners, and also as learning material and food for further thought as such. The comments also advised the last stretch of the research in to what extent the presented cases "resonated" among the partners, and how relevant they found them against their own ongoing work and challenges, and how to improve the presentation and coverage of the cases for the final report.

At the point of time of the ongoing work we chose mainly 'living lab' (LL) experiences, which were best on offer as rich and concrete examples of Quadruple Helix type of innovation activity, which clearly differentiates itself from the Triple Helix type. The examples were by no means exhaustive of the QH world and challenges, and not suggestive of delimiting QH to LL only.

On the basis of the Case Reader we asked for reflective comments in a short "essay form", reflecting on the material against each one's experience – the experience and challenge of enhancing innovation, and particularly user involvement in innovation in the region. A couple of "prompting questions" were provided:

(1) Do these cases illuminate the kind of experience and problematic that is relevant and useful in your regional context concerning building user involvement in innovation?
(2) Do you have any specific comments on the role and challenges of local/regional government in promoting user involvement in innovation?
(3) Is there something missing, from your perspective, that is relevant for you concerning enhancing user involvement in innovation in your region?
(4) Where are the efforts of building user involvement concentrated in your region right now and the near future?
(5) Is there an example you would want to share/point out, as an interesting new development in user involvement from your region, or elsewhere?

Altogether 13 reflective comments were given on the Case Reader representing 6 partners (Ulm, Girona, Jyväskylä, Gävle, Eskilstuna and Crete). Several people responded from Gävle and Eskilstuna.

It was clear from the comments that the degree to which QH, user involvement and living labs in particular are an actuality or relevant in the different contexts, varied to a great degree, corroborating also the picture attained in the Questionnaire. For those who had already more experience concerning different aspects of QH kind of activities, including examples of intensive user involvement and living labs, many of the cases and learning points were found highly relevant. This does not mean that ALL the cases, or the way they were presented, were considered as relevant or adequate. In some comments it was emphasised that QH is not delimited to LL, which was not the message of the researchers, either.

The reflective comments took up a rich set of themes and questions, which were very helpful in terms of improving the final report. The ideas and aspects taken up in the comments have been used to enrich our report, the cases, conclusions and recommendations.

Without doing justice to the richness of the comments, some key themes and messages are picked up here. These included in particular the following:

- The shift to citizen and user orientation is a big cultural change, not just a small operation – be it in the public or private regime - and must be underpinned with many different aspects and skills in order to be robust and sustainable;

- Local and regional authorities have an important role in QH, via strategic use of resources, integrating knowledge and skills in innovative thinking, community building, procurement and regulation, grants, rewards – but they also have big needs for their own ability and skills development and many constraints in terms of inflexibilities and bureaucracies;

- Involvement in the innovation process must be seen broadly enough, containing the possibility of being an individual idea resource even without being an actual user of a certain product, or even wanting to be one;

- The process of integrating knowledge of innovative thinking, user involvement, accessibility and inclusion empowers communities to become stronger drivers of innovation – and this in turn feeds into a more inclusive society, "as a bonus";

- On the other hand there are also risks of selection mechanisms in user involvement (like levels of 'digital literacy') and participation, which need to be addressed;

- There is a need to be aware and skilled in local and regional government to negotiate a good balance between organising and controlling and "letting the people do it themselves" in participative processes, lest risking stifling the processes;

- There is a whole set of important questions to be addressed concerning the ownership, commitment, rights and legal issues of the participative processes;

- Changes in web-based services can help to accelerate the processes of user involvement.

6. Research results

In this chapter we are answering to the following research questions:

1) What is a Quadruple Helix (QH) innovation model?
2) Can QH bridge the "innovation gap" between civil society and innovation ?
3) What kind of good practices there are related to QH activities?
4) How local authorities can promote QH activities, what kind of roles they could have in QH environment?

We start by answering the first question, what is a Quadruple Helix (QH) innovation model?

6.1. The Quadruple Helix Models

"Quadruple Helix" (QH) is not very well established and widely used concept in innovation research and in innovation policy. The concept also has no well-established definition. A clear springboard for this concept is of course the Triple Helix concept. Triple Helix (TH) describes a spiral shaped innovation co-operation between firms, universities and public organizations. The concept tries to capture the multiple reciprocal relationships of different innovation actors at different points of innovation process. Quadruple Helix adds another helix and actor group to TH innovation co-operation model. After reviewing literature related to R&D&I activities, we came in to the conclusion that there is a wide range of conceptions or approaches, which could be named as QH type of innovation conceptions. Some of them are very close to TH concept, some deviate more radically from it, and many of them are somewhere between these two extremes. What is common to all QH type of innovation conceptions is that they all have included some fourth group of actors into the TH model. As we have already brought forward, we argue that this fourth helix should be

users. Accordingly, Quadruple Helix can be seen as describing innovation co-operation between firms, universities, public organizations and users.

Based on that, we have formed a general definition of QH innovation model: it is an innovation co-operation model or innovation environment in which users, firms, universities and public authorities co-operate in order to produce innovations. These innovations can be anything, which is considered useful for innovation co-operation partners, they can be, for example, technological, social, product, service, commercial and non-commercial innovations.

As we can see from the above, it is more useful and meaningful to consider Quadruple Helix rather as a continuum or space than a single entity. Accordingly, it is more useful to talk about different QH models situated somewhere along the QH continuum or space. In each case the QH model to be constructed depends on the perspective one chooses. In our research paper we consider it mainly from the innovation perspective, especially from the perspective of innovations related to the development of products and services either in private or in public sector. In order to make some interesting dimensions and possibilities of QH explicit, we have constructed four different types of QH models, 1) "TH + users model", 2) "Firm-centred Living Lab model", 3) "Public sector - centred Living Lab model" and 4) "Citizen-centred model" (see Figures 10, 11, 12 and 13 below). These models are ideal types of models and they are not meant for describing the reality as it is. The purpose of them is to bring forward some essential characteristics of different QH models more clearly, and to give examples of the application possibilities of QH. The real QH innovation environments and co-operation models most probably contain elements from several different QH models.

Next we introduce these four models and their essential characteristics. From the four QH models presented here the first two (TH + users and Firm-centred Living Lab) seem to be very much reality already today in several countries. Public sector–centred Living Lab model seems also to be in use at least in different projects related to the development of the public services. At the moment Citizen-centred model is most likely the most infrequently utilized QH model of these four models. It provides the biggest challenges to firms, universities and public authorities, who are not used to give the steering wheel/driver's seat to the citizens in innovation activities.

6.1.1. Triple Helix + users

"Triple Helix + users" model (Figure 10 below) is otherwise the same as the traditional TH model except for the systematic collection and utilization of user information. The focus is on the development of commercial high tech innovations, based on latest scientific research knowledge. The owner of the innovation process can be a single firm, group of firms, university, group of universities, or a group of firms and universities. In this model the degree of user involvement could be characterizes as design for users (see Chapter Defining user and user involvement). The users are participating either indirectly in the innovation process, i.e. giving information about their needs, for example through surveys, or participating in the innovation process at very late phase, when the developed products or services are nearly completed. Users are treated as informants, not as developers. In other words, they are treated merely as objects of innovation activities, not subjects of them. The information given by the users is not taken at face value. The decisions and interpretations concerning the (real) needs of users (consumers) are made by experts working in high tech firms or in universities.

Figure 10. Triple Helix+ users model.
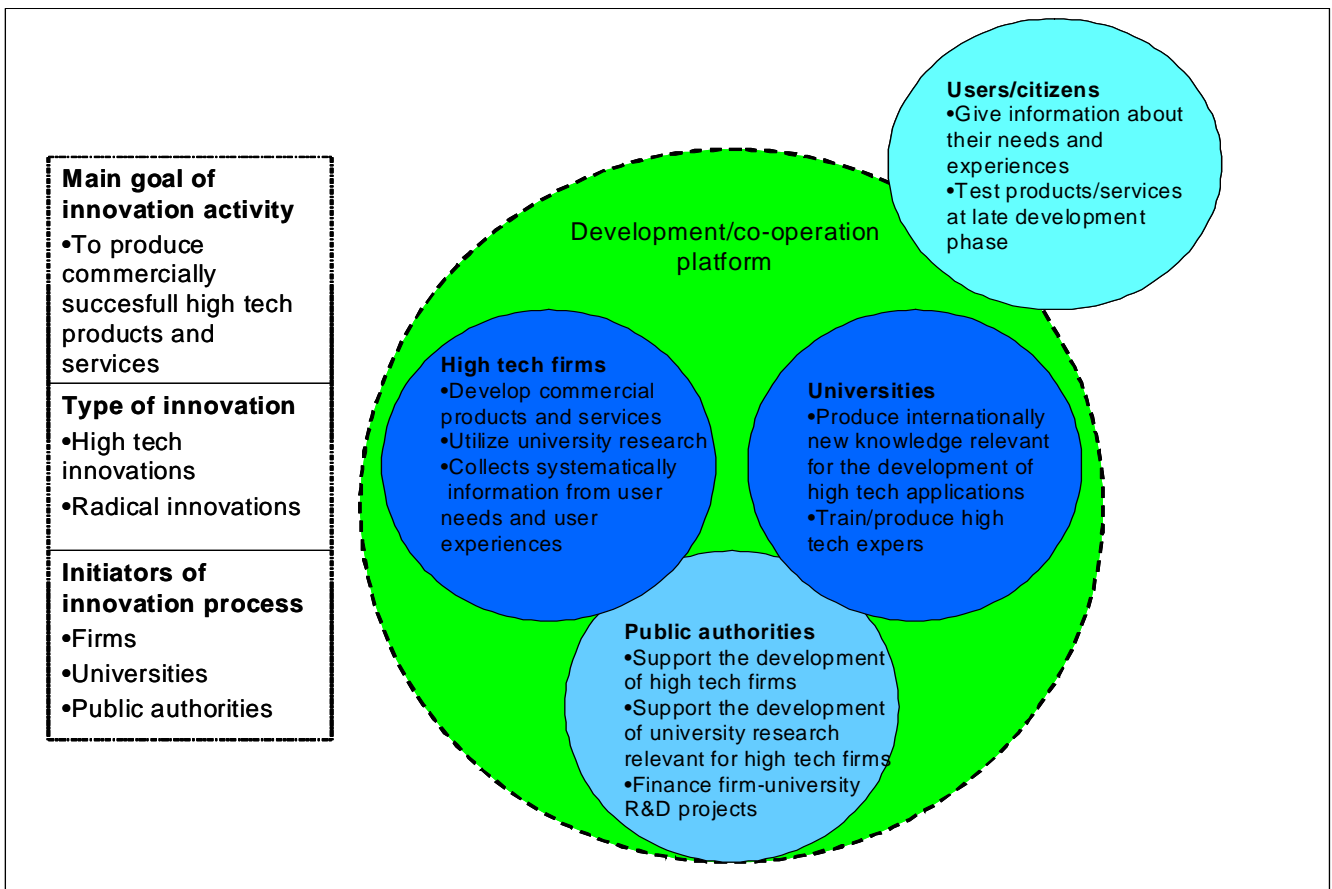
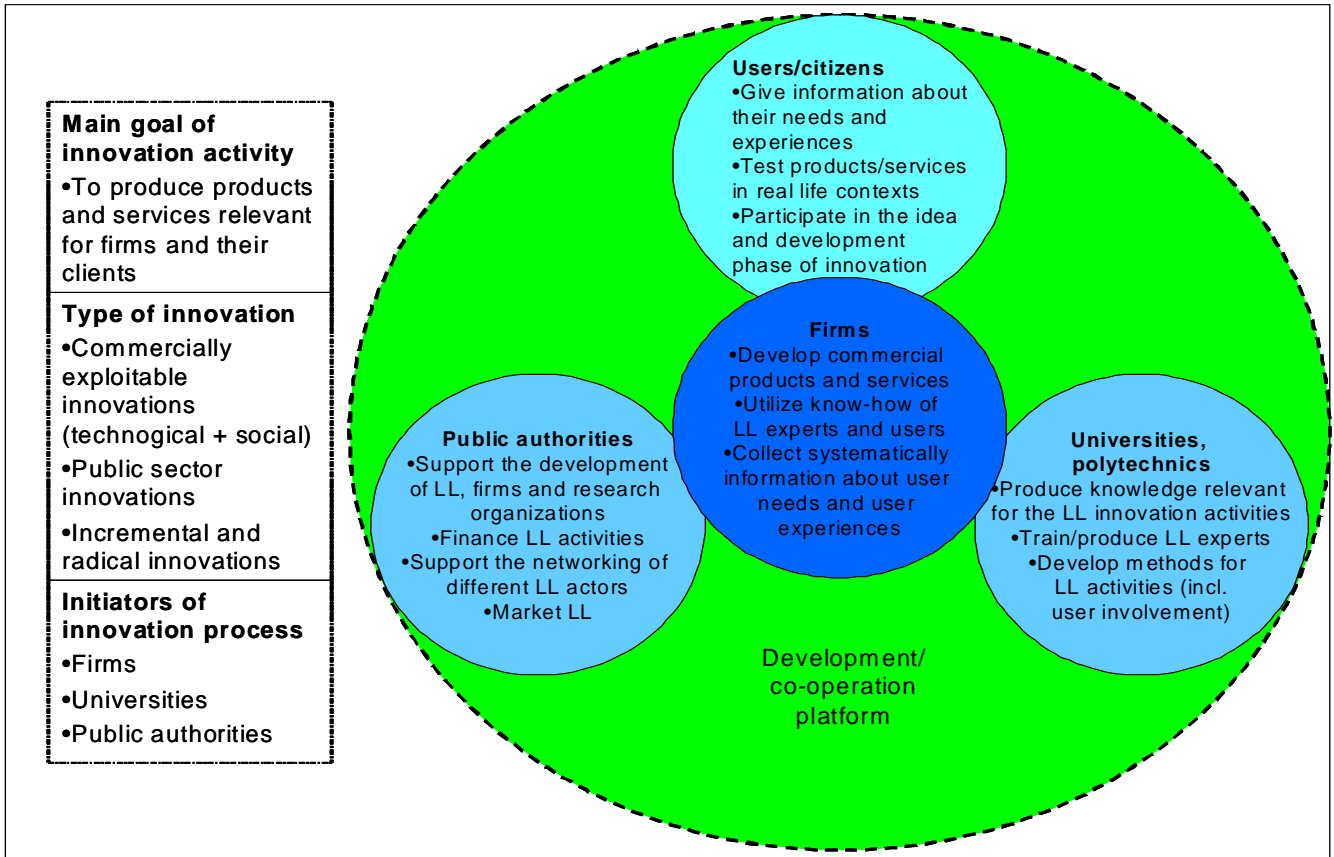In the "Triple Helix + users" model public authorities have following kinds of roles:

- to support the development of high tech firms and universities;
- to support the networking of TH actors;
- to finance R&D&I projects related TH + users type of innovation;
- to support regional and local development which supports the promotion and utilization of TH + users type of innovation;
- to market TH + users innovation environments for high tech firms and researchers;
- to support research relevant to the development and commercialization of high tech products/services and for the development of TH + users type of innovation environments and activities; and
- to support the systematic collection and utilization of user information (incl. the development and utilization of the tools and methods suitable for this purpose).

6.1.2. Firm-centred Living Lab

In the "Firm-centred Living Lab" model (Figure 11 below) the focus is also on the development of commercially successful innovations, but in this case, innovation can be based on, in addition to latest research knowledge, also on new applications or combinations of "old" research knowledge and/or on user knowledge. With user knowledge is in this case meant knowledge both about the needs and problems users face in real life contexts and about these contexts of use. The owner of the innovation process is a firm or group of firms. In this model the degree of user involvement could be characterizes as design with users (see Chapter Defining user and user involvement). Users

are treated both as informants and as developers. This means that the users participate also in the early phases of innovation process, for example, in the idea and development phase. In this model user knowledge can be as important as research knowledge.

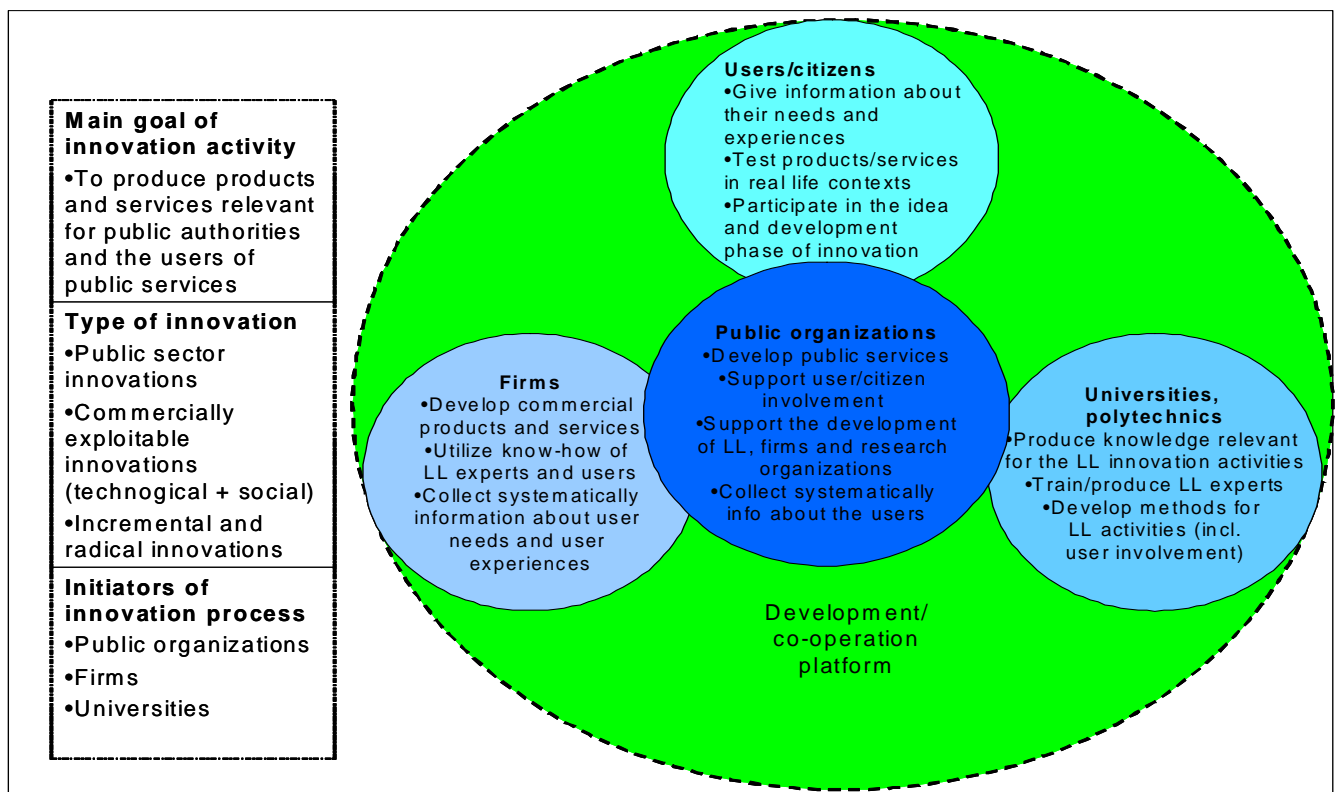**Figure 11. Firm-centred Living Lab model.**

In the "Firm-centred Living Lab" model public authorities have following kinds of roles:

- to support the development of firm-centred QH innovation environments like living labs (LL) and the main actors of these environments (incl. firms and research organizations);

- to support the networking of firm-centred QH/LL innovation actors;

- to support regional and local development which supports the promotion and utilization of firm-centred QH innovation;

- to market firm-centred QH/LL environments and the services they provide for firms, users and public organizations;

    o to increase the awareness of firms, especially SMEs, of these innovation environments and of how they can utilize these environments and user involvement in their development activities;

- to support the development of research relevant for firm-centred QH/LL environments and activities;

- to finance R&D&I projects related to firm-centred QH innovation;

- to support the systematic collection and utilization of user information (incl. formation of user communities) relevant for firm-centred innovation; and

- to support the development and to improve the awareness of user-oriented development and research methods/tools supporting firm-centred QH innovation.

6.1.3. Public sector –centred Living Lab

In the "Public sector -centred Living Lab" model (Figure 12) the focus is on the development of public organizations and services. Also in this case innovation can be based on, in addition to latest research knowledge, also on new applications or combinations of "old" research knowledge and/or on user knowledge. The owner of the innovation process is different from that in the Firm-centred Living Lab model, in this case it is some public organization or group of public organizations. The goal of innovation activity is, above all, to develop public organizations so that they can function better and offer new and better products and services to their clients, to the citizens. In addition to firms, also public organizations gather systematically information and feedback from the clients of their services, i.e. from citizens. This can be realized with the help of more traditional information gathering methods (e.g. surveys, interviews), or by organizing dialogue forums (virtual and real) for citizens. Also in this model the degree of user involvement could be characterized as design with users (see Chapter Defining user and user involvement). In other words, the users/citizens participate in the development work of public services together with R&D experts.

Figure 12. Public sector-centred Living Lab model

In the "Public sector -centred Living Lab" model public authorities have following kinds of roles:
- to support the development of public services with the help of living labs and user-oriented development methods;
  - to support citizens' involvement in the development activities of the public organizations;
  - to collect and utilize systematically information about the citizens' needs and experiences concerning the functions of the public sector;
- to support regional and local development which supports the promotion and utilization of user-/citizen-oriented QH innovation made in public sector;
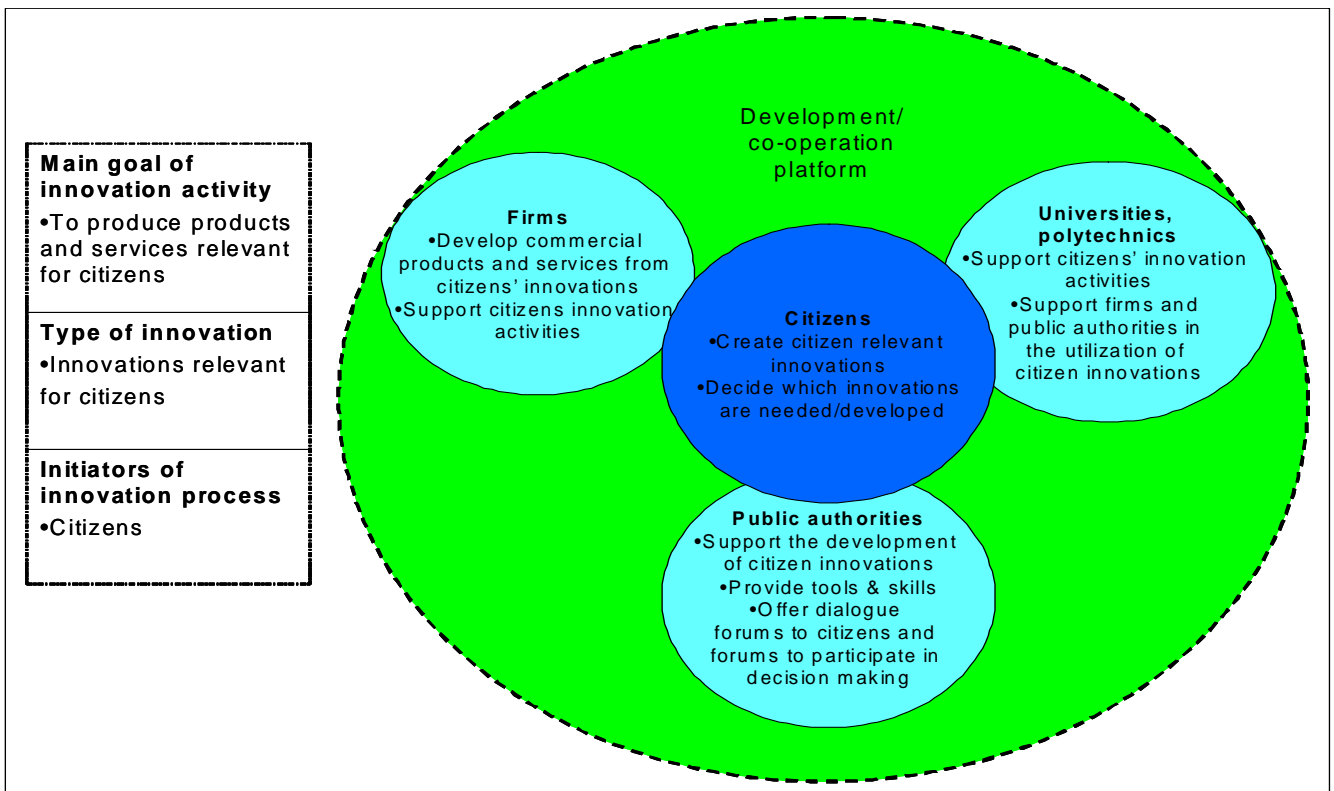
- to support the development of LL and the main actors of these environments (incl. public organizations, citizens, firms and research organizations);
- to support the networking of public sector-centred QH/LL actors;
- to market QH/LL environments and the services they provide to public organizations, citizens and firms;
- to support the development of research relevant for QH/LL environments specialized in the development of public organizations;
- to finance R&D&I projects related to QH innovation in the public sector;
- to support the systematic collection and utilization of user information (incl. formation of user communities) from the public sector; and
- to support the development and to improve the awareness of user-oriented development and research methods/tools supporting QH type of innovation co-operation in the public sector.

6.1.4. Citizen-centred QH

In the "Citizen-centred QH" model (see Figure 13 below) the focus is on the development of innovations relevant for the citizens. In this innovation model citizens are on the driver's seat and the innovations produced can be based on the knowledge of the citizens, firms, universities and/or public authorities. Owner of the innovation process can be a single citizen or a group of citizens (i.e. a development community). In this model the degree of depth of the user involvement could be characterized as design by users (see Chapter Defining user and user involvement), i.e., new products, services and ways of doing things are developed by the users. Besides making most of the development work, citizens also decide which kinds of innovations are needed and developed. The role of firms, public authorities and universities is, above all, to support citizens in their innovation activities (e.g. to provide tools, information, development forums and skills needed by the users in their innovation activities). Firms and public organizations also utilize the innovations made by the citizens.

Figure 13. Citizen centred QH model.

In the "Citizen-centred QH" model public authorities have following kinds of roles:

- to promote the empowerment of the citizens and to assist citizens in their innovation activities;
    - to support the development of citizen innovations;
    - to provide tools and skills needed by the citizens in their innovation activities;
    - to offer dialogue forums to citizens and forums to participate in decision making, and to assist them in their innovation activities;
- to support the development of QH type of innovation environments which are able to support and utilize citizen-centred innovation activities;
- to support regional and local development which supports the promotion and utilization of citizen-centred innovation;
- to support the networking of citizen-centred QH innovation actors;
- to market citizen-centred QH environments and the services they provide to citizens, firms, and public organizations;
- to support the development of research relevant for QH environments specialized in citizen-centred innovation;
- to finance R&D&I projects related to citizen-centred QH innovation;
- to support the systematic collection and utilization of information supporting citizens in their innovation activities (all kinds of information in addition to information related to citizens themselves); and
- to support the development and to improve the awareness of citizen-centred development and research methods/tools supporting citizen-centred QH innovation.

6.2. Civil Society and QH

The challenge of connecting civil society better to innovation, or bridging the 'innovation gap' of the civil society and innovation can be considered from two perspectives: from the perspective of firms and from the perspective of local/regional/national authorities.

If it is considered first and foremost from the perspective of firms, it can refer to the "technological innovation gap", and/or to the "trust/moral gap". Technological innovation gap means the insufficient capability of European firms for translating their technological know-how into successful business cases with significant commercial and societal impacts. One indicator of this innovation gap is the fact that the number of technology patents of European firms is much higher than the number of commercially successful products/services based on patented technology (Santoro & Conte 2009).

Trust gap/moral gap means that citizens do not necessarily trust the break through technologies developed by the firms and public research organizations, or they can consider these technologies and the use of them unethical or un-ecological. This trust/moral gap has become visible in the case of nuclear energy technology and biotechnology. If this innovation gap is considered from the perspective of authorities, then it means the insufficient capability of local, regional and national authorities to involve citizens into the development of public services and organizations.

Related to the main goals of the CLIQ project, we have paid keen attention to the perspective of firms considering the challenge of connecting innovation and civil society. This is in order to obtain focus and emphasis on practical company needs and relate the challenges of local and regional authorities to these. With this emphasis civil society means mostly users (consumers) who are using the products and services produced by firms and services produced by public organizations.

According to Santoro & Conte (2009) living labs type of innovation approach could bridge the innovation gap between technology development and the uptake of new products and services involving all relevant players of the value network via partnerships between business, citizens, and government. To what extent living labs really can bridge this gap remains to be seen. There is not yet enough empirical research data related to living labs to make a reliable and valid estimation of this. The first two QH models, Triple Helix + users and the Firm-centred Living Labs, in particular, but not exclusively, provide examples and practices of bridging the technical innovation gap.

The innovation gap of the civil society and innovation can also be understood as insufficient possibilities of citizens to have a bearing on the innovations developed by firms and R&D organizations. As we have already mentioned (see Chapter 3.4.), user involvement can be divided into two strands: an approach which focuses on the role of the service user as a mere consumer of services (consumerist) (see, for example, Brown, 1997), and another which emphasises a clearer role of users in decision making (collectivist) (Hoggett and Hambleton, 1987). Criticisms have been raised against local authorities that apparently focus on the first approach whilst neglecting the second, since although a consumerist approach might entail changing services to meet the needs of customers and ensuring moreover that those services are accessible, it does not address the issue of power (Leach /et al/., 1994). Hence, it does not change the position of those on the receiving end of the services.

Turning to the collectivist approach, which implies a role in decision-making, this has been further divided into representative democracy and direct democracy (Hoggett and Hambleton, 1987). The former implies the role of councillors as advocates, and the latter suggests that the public have a direct input into how services should be provided. Taking the idea of direct democracy further, Hoggett and Hambleton identify three types of strategy for involving the public in decision making: resourcing non-statutory organisations, community development, and the involvement of user groups. However, the authors accept that both strands of a collectivist approach can also be criticized. It has been argued, for example, that representative democracy might be paternalistic, passive and minimalist, and on the other hand, that direct democracy could be sectional and parochial. Therefore, they recommend using a combination of the two types of approach in order that one might compensate for the deficiencies of the other.

Clarke and Stewart (1992) go further and suggest that there should be a third facet to the public's role: rather than being perceived as individuals, the public should be regarded as members of the community. In this model, empowering the public as a customer involves extending choices or clarifying the service to which they are entitled, giving them the means to complain, and providing equality and ease of access. In contrast, by empowering people as citizens, the public are entitled to a share in decision making, which necessitates being clear about their rights. And, thirdly, empowering the public as community means giving them direct control, and the right to determine wherever possible those issues affecting the community, with the creation of new democratic frameworks where appropriate.

The Public sector-centred Living Labs and the Citizen-centred QH models, in particular, but not exclusively, provide examples and practices of addressing these broader community and democracy perspectives.

The situation in relation to these complex community, culture and democracy issues vary considerably between, and within countries. The degree of decentralisation and devolution between central and local government, the powers of the different tiers of government etc. differ, and thus also the possibilities and relevance of connecting the civil society and innovation. It is probable that the experience *outside* explicit innovation activities of the local and central authorities contain a

wealth of practices that could feed positively into innovation, like building platforms, interfaces and forums for participation in decision making. Good practices in involving and empowering customers, in public services likewise, already contain a wealth of experience of how to really involve people.

The issue of power is very seldom addressed in QH literature, even if there is a clear (but implicit) inbuilt tension and a potential conflict of interest included in the QH innovation activities involving the user: how much decision making power is delegated to the user and how much the user can benefit from the innovations he/she has been co-developing vs. decision making power and benefits of firms, QH experts and public authorities.

6.3. Good practices coming from the Good QH cases

6.3.1. Constraints in identifying good practice in QH

As it is clear from all the above in this report, finding good practice in QH is a demanding task because QH is still far from an established model and because it is rather a continuum than a model/concept with clear boundaries. Furthermore, because comparatively little research and in-depth descriptions are made about QH type of innovation activities, so far this model is at best more like a promising or interesting model than actual good - or indeed - best practice. Also, at the end of the day, good practice is always a locally embedded practice, which cannot be simply transferred elsewhere as a commodity, but rather, applied through a learning process. The more complex the practice, the more demanding and complex the learning process needed in between. Public authorities have an important role in promoting the platforms of such complex learning.

Furthermore, it is also clear that the cultures, goals, stages of development and available resources in terms of structures, funds and actors differ considerably in different localities, regions and countries. This is apparent also among the CLIQ partners.

All this means that unequivocal identification of good practice, or recommendations concerning it in universalistic terms, is impossible. Rather, a contingency/configurational approach (Whittington et. al 2003) is needed, where there are several constellations of success, and the only "universalistic" recommendation is to enhance the regional interactive learning process.

The observations and recommendations on good practice concerning QH are written with these constraints and points of departure in mind.

6.3.2. Good practices in various aspects of QH promotion

From our good QH cases (see Chapter Good QH cases) we can find the following good QH practices related to the forming and implementation of QH development platforms/innovation environments and to supporting user involvement in QH type of innovation activities. The practices are assorted according, firstly, to the QH challenges they are related to, and secondly, to the development phases of QH innovation process.

Challenge: How to construct a QH type of innovation environment

In order to form a functional and successful QH type of innovation environment, one needs good and approved guidelines and a "check-list" for guiding the design and implementation of QH type of innovation co-operation environment. One good example of these kinds of guidelines is provided by Santoro and Conte (2009), who have made the implementation guidelines for living lab type of innovation environment. They argue that this implementation recipe is believed to be suitable for many different contexts and it contains the essential ingredients of a living lab (Santoro & Conte 2009). They break down the guidelines and the construction process of a living lab into two phases: a) Living lab set-up and b) living lab operations. A short description of these phases is presented in Tables 16 and 17. A more detailed description of these two phases can be found from chapter Good QH cases (Tables 10 and 11)(Santoro & Conte 2009).

Table 16. Living Lab set-up phase.

Living lab set-up
1. Establishment of the community of service/technology developers
2. Establishment of the community of public/social stakeholders
3. Establishment of a community of professionals from academia, public administration, industry and consultants
4. Establishment of a community of users
5. Definition of the legal entity representing all Living lab actors
6. Set-up of a supporting IT Collaborative platform
7. Identification of a Living Lab performance model

Table 17. Living lab operation phase.

Living lab operation
1. Identification of idea development and/or demand creation mechanisms
2. Identification of a specific group of service/technology developers
3. Identification of the living lab trial tutor
4. Identification of the living lab trial requirements
5. Identification of a specific user group by the trial tutor
6. Identification of a Virtual Team of experts by the trial tutor
7. Establishment of the living lab trial plan
8. Set-up of the living lab trial IT environment
9. Conduction of the living lab trial
10. Results analysis of the living lab trial

Challenge: How to avoid possible stumbling blocks of QH activities

Before launching a QH type of innovation co-operation environment it is also very useful to acquaint oneself with approved practices helping you to avoid possible challenges related to this type of co-operation environment. Here we have collected some useful practices which can help to avoid these QH stumbling blocks:

a) QH partners of innovation should form a common understanding and definition of QH innovation co-operation/environment (e.g. what is meant by it, what are the goals of it, what kind of innovations are pursued)

b) It is also important to create an open positive arena that is based on trust between the QH partners.

c) The roles of different QH partners should be described accurately before the QH environment is launched.

d) QH partners should also make an assessment of operational risks related to QH activities/co-operation before the launching phase. This helps partners to brace themselves for coming spots of danger. QH type of innovation activities consists of many risks. Firms and public authorities must be prepared, for example, for risks associated with direct contact with users and citizens. User co-operation must be managed correctly in order to avoid misunderstandings and disappointments on both sides. In the worst case users can turn against the organization utilizing them in its development activities.

e) QH partners should make a communication strategy concerning QH environment and the achievements of this environment. This strengthens the brand and visibility of the QH environment they have created.

f) QH partners should learn to identify the different perspectives of QH partners on the innovation(s) at hand.

g) QH partners should also learn to make conflicting interests explicit and to discuss them openly.

h) QH partners should learn to use right methods in different development phases of a QH innovation process. An example of this is given by the Sekhukhune Living Lab case presented in chapter Good QH cases.

i) QH partners should also make a clear scheduling and division of labour in different QH projects and activities.

j) QH environment should utilize researchers widely in QH activities, especially research and researchers specialized in user involvement and in QH type of innovation activities in general. This should be made one essential part of QH activities.

k) QH partners doing development work in QH environment should be trained to utilize user/citizen involvement methods. Examples of the approved user and citizen involvement methods are given in Good QH case chapter. These cases present lead user -method, involving ordinary users -method, involving online user communities -method and involving citizens in the development of public services -method.

l) QH developer organizations should also learn to identify the right users in relation to the type innovations they seek and to the target group of these innovations (see Halmstad Living Lab in Good QH case chapter).

m) A very important skill for QH developer organizations is the skill related to motivating users. In order to be able to find and involve users in their development activities, QH organizations have to be able to motivate the users. Examples of user motivation means are given in the Finnish Living Labs case. One way to motivate users is appealing to common goals and benefits of the user and the QH project. Users can also be offered a possibility to have a concrete effect on the product or service the user him-/herself uses or his/her fellows use, or they could be promised to have an observable recognition, e.g. in the webpage of a firm, that the user has participated in the development work. From the case "Involving online user communities" we can learn that in order to keep up the motivation of users organizations should carefully consider how they acknowledge and interact with user innovation communities. It is important to show that the ideas presented by a user community are respected and taken seriously into consideration by the organization exploiting these ideas. Organization can prove this to users by responding to the ideas presented by the users quickly enough and by withstanding the intensity of the users' demands and by having enough absorptive capacity to be able to realize and apply the ideas presented by the users.

n) In order to improve the QH activities and make the QH environment function better it is important that the QH projects and activities are documented and reported well (e.g. real time reports are made). Relating to this it is also important that each QH case/project is evaluated.

Challenge: How to utilize ordinary users effectively in innovation activities

It is not enough just to involve ordinary users, it is also important how you do this. If you do not want to content yourself with the ideas already known to or variants of services already implemented, it is not enough to merely ask the ordinary users, if they have any ideas. Customers only know what they have experienced and have trouble in imagining, for example, the use of emerging technologies or practices. In "involving ordinary users" –method the users are activated into problem solving in their own day-to-day environments and they are given newly acquired knowledge related to the product/service to be developed. The users are encouraged to discover new, and as yet unknown, needs; these needs would probably not have been discovered during a traditional inquiry process.

Challenge: How SMEs can benefit from QH type of innovation activities

SMEs need special support and help in user-oriented innovation activities. One good way of supporting them in this is to form a living lab type of innovation organisation and environment, which offers SMEs services supporting the utilization of users and user knowledge in their innovation activities. But this is not enough; SMEs need also support in the utilization of QH type of innovation environment. Good practices related to this are the following:
- SMEs should have a representative in QH activities, so that they could learn how to perform different QH activities by themselves (see case Halmstad Living Lab).
- After each QH project, possible business model opportunities should be discussed with the enterprises so that they could better exploit these opportunities in forthcoming projects and activities (see case Halmstad Living Lab).
- In order to stimulate SMEs to work more user-oriented and to involve users in their innovation activities, representatives of SMEs should be involved in research projects related to QH, so that they can observe and get a first hand experience of how researchers plan and carry out user involvement in those projects (see case Halmstad Living Lab). It is also important to train SME representatives to utilize different user involvement methods.

6.4. The roles of regional and local authorities in promoting QH

When the roles of public authorities (inc. regional and local authorities) in promoting QH are considered, it must be noted that the role of public authorities and the ways they have been affected by the QH activities is still an under-researched and -documented topic. There is a lack of research, for example, on the roles of different public authorities - what kind of role different public actors, e.g. state, regional and local authorities have - in QH type of innovation activities and on the challenges user involvement gives to the public authors. However, we can find good ideas and examples of the possible roles of regional and local authorities from living lab literature, from our Good QH case studies, from the four QH models formed by us and from user-driven innovation policy literature.

Rönkä and Orava (2007) have defined four main roles for the actors of Quadruple Helix (QH) and living lab (LL) type of development platform. These roles are enabler, utilizer, developer and user. Rönkä and Orava have a rather traditional conception of the innovation roles of firms, public authorities, universities and users. The roles and typical representatives of them (as seen by Rönkä and Orava) are presented in Figure 14. Rönkä and Orava (2007) also argue that in order to function a QH type of development platform needs also some kind of manager, networker or moderator, which acts as a node. Described on a general level, the task of the enabler is to make possible the development of QH or LL process, for example, by giving funding or a building lot for LL development platform. The role of the enabler concerns besides developers and utilizers, also users. Utilizers utilize products and services developed in the platforms in question. The task of the developer is to bring R&D&I know-how into living labs. The task of the user is to give information of his/hers needs, use the experiences and ideas. (Rönka & Orava 2007)

Figure 14. User centric Quadruple Helix (applied from Rönkä et al. 2007)
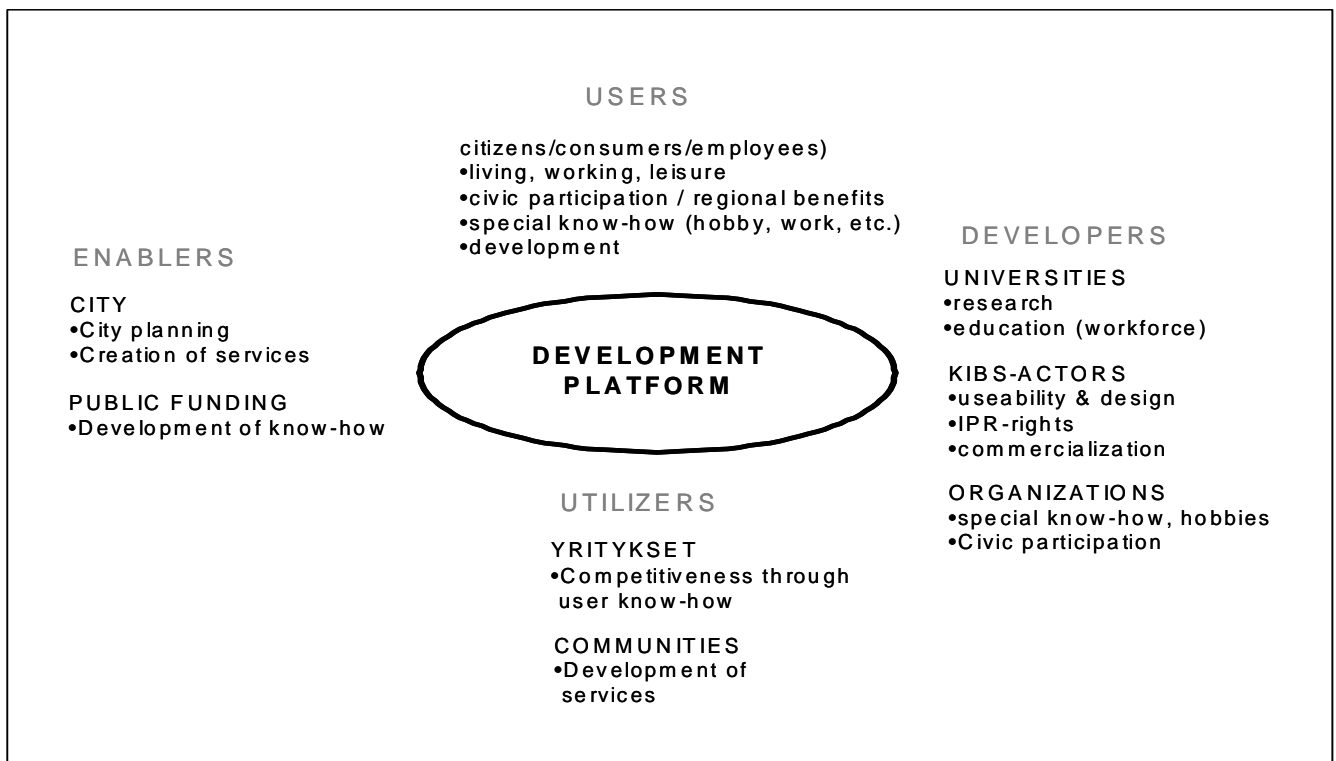
Our study illustrates that this kind of rather fixed and oversimplified role map represented in Figure 14 can be somewhat misleading. In reality the roles of the public authorities are much more versatile, and furthermore, these roles are not fixed, and the same actors (e.g., user or city) can have different roles in different contexts. For example a consumer can be both a user and a developer, a public organization like a city can be besides an enabler also a developer and an exploiter, and a university can be besides a developer also an enabler. Next we become acquainted with the roles offered to public authorities by the living lab literature.

6.4.1 Roles offered to regional and local authorities by living lab literature

We made a review of the living lab literature (e.g. Magnusson et al. 2003, Almirall & Warenham 2008, Pascau & Lieshout 2009, Orava 2009, Santoro & Conte 2009, Svensson & Eriksson 2009, Svensson et al. 2010, Wise & Høgenhaven 2008) and found out that the roles of public authorities in a QH environment are much more diverse than those presented by Rönkä and Orava (2007). The reviewed living lab literature includes the living lab cases presented in chapter "Good QH cases". The roles given to the public authorities in living lab literature are gathered to Table 18.

Table 18. Roles offered to regional and local authorities for promoting QH by living lab literature

1. Enabler
• financier of LL activities (incl. through project funding, ownership, investments and public procurements)
• giving building lot for living lab infrastructure
• acting as regional developers and town planners (living labs have often been geographically bounded innovation environments, e.g. part of a city, or a rural area)
2. Decision maker
• member of the steering group
3. Supporter
• supporting the development of LL firms
• supporting the identification of the main stakeholders
• supporting the establishment of communities of different LL stakeholder groups (e.g. service/technology developers, public/social stakeholders, community of users
• supporting the linking and networking of different groups and stakeholders
• acting as one member of LL professionals, which give advice and support to the definition of LL and experimentation of the proposed service/products
4. Utilizer
• utilizing the development services of LL by themselves (as part of the development of public services)
5. Developer
• e.g. employees of public organizations participating in LL development activities
6. Marketer
• organizing business/idea competitions and awards
• marketing LL to businesses, users, other financiers
7. Quality controller
• supporting the development of "quality checks" or standards for LL type of activities and for other co-creation environments
• assessing the quality of LL type of activities with the help of these standards

6.4.2. Roles offered to regional and local authorities by the four QH models

We can also learn something about the possible roles of public authorities from the QH models presented above (see Chapter QH models). One important lesson to be learned from these models is that the roles of public authorities differ in different QH models. In Table 19 the main roles of public authorities in four different QH models are presented.

In Triple Helix + users model the roles of public authorities are to a large extent same as they have been in traditional high tech -centred technology, science and industry policies implemented in several countries. The main role of public authorities is to support the development of high tech firms and universities, to support the development of university research relevant for high tech firms and to finance firm-university R&D projects. In addition, public authorities and especially public financiers of R&D&I activities can also support the systematic collection and utilization of user information in this model.

In Firm-centred Living Lab model the main role of public authorities is to support the development of firm-centred QH innovation environments and the promotion and utilization of these environments. Correspondingly in the Public sector centred Living Lab model one essential role of the public authorities is to support the development of the public sector -centred QH innovation environments and the promotion and utilization of these environments. Another important role for them is to support the development of public services with the help of living labs and user-oriented development methods.

In Citizen-centred QH model one essential role of the public authorities is to support the development of QH type of innovation environments which are able both to support and utilize citizen-centred innovation activities. Another important role for them is to promote the empowerment of the citizens and to assist citizens in their innovation activities, for example, by providing tools and skills needed by the citizens in their innovation activities, and by offering dialogue forums to citizens and forums to participate in the decision making and to assist them in their innovation activities.

Table 19. Roles of regional and local authorities offered by the four QH models.

	TH + users	*Firm centred LL*	*Public sector cantered LL*	*Citizen centred QH*
to promote the development of	high tech innovations developed in TH innovation environments by R&D experts	commercially successful innovations developed in firm centred LL innovation environments	public sector innovations developed in public sector centred LL innovation environments	innovations developed by citizens with the help of QH environments
to promote the networking of	TH actors (firms, universities and public authorities)	actors of firm centred LL innovation environments (firms, universities, public authorities and users)	actors of public sector centred LL innovation environments (firms, universities, public organizations and users/citizens)	actors of citizen centred QH innovation environments (citizens, firms, universities, public organizations)
to finance R&D&I projects related to	high tech innovation and TH + users type of innovation co-operation	firm centred LL innovation and innovation environments	public sector centred LL innovation and innovation environments	citizen centred QH innovation and innovation environments
to promote regional & local development supporting	the application of TH + users innovation model for producing high tech innovations	firm centred LL innovation model/ environments for producing all kinds of commercially successful innovations	public sector centred LL innovation model/ environments for producing public sector innovations	citizen centred QH innovation model and environments for producing innovations relevant for citizens and for other QH actors
to market	TH + user innovation environments	firm centred LL innovation environments	public sector centred LL innovation model/ environments	citizen centred QH innovation model and environments
to promote research relevant for	the development and commercialization of high tech products/services in TH + users type of innovation environments	the development of commercially successful innovations developed in firm centred LL innovation environments and for the development of these environments	the development of public sector innovations developed in public sector centred LL innovation environments and for the development of these environments	development of citizen centred QH innovation and QH environments specialized in citizen innovations
to support the systematic gathering and utilization of user/citizen info relevant for	high tech oriented TH + user innovation	firm centred LL innovations	public sector centred LL innovations	citizen centred innovations
to support the development and improve the awareness of methods& tools relevant for	utilizing users for the development of high tech innovations in TH innovation	utilizing users in firm centred LL innovation	utilizing users/citizens in public sector centred LL innovation	supporting citizens in their innovation activities and for other QH actors utilizing these innovations

6.4.3. Roles offered to regional and local authorities by the user-driven innovation literature

It is argued that changing over from a research-/technology –driven innovation models to a user-centred innovation models necessitates for organizations (incl. firms, universities, public authorities) using them a very big change, for example, in the ways their development employees (e.g. development experts) are used to think (perspectives) and do (development routines) things (see Wise & Høgenhaven 2008). As a result of this change the people working in these organizations have to learn an entirely new set of innovation skills and routines (Wise & Høgenhaven 2008). The public sector can play an important role in this transformation process. For example, it can support firms in this change in same way as it did during the innovation of the Industrial Age, where the most important factor was to gain a technological advantage. There are several ways in which the public authorities can support this change (and at the same time user-oriented QH activities). The challenges presented by the new innovation model do not limit themselves to businesses. User-oriented innovation is also a challenge for innovation supporting agencies that aim at effectively helping enterprises to innovate faster and better.

Examples of the roles of public authorities in QH type of innovation activities can also be found from the recent discussions related to user-driven innovation policy (see Finnish Ministry of Employment and the Economy 2009). As the QH innovation models can be seen as one representative of user-driven innovation model, it can be argued that the same type of policies can be used for the promotion of QH type of innovation co-operation and environments that are suggested for the promotion of user-driven innovation.

In Table 20 are presented the measures which are supposed to support the implementation of user-driven innovation in firms and in society at large. They have been broken down into four main themes: knowledge and capability development, regulatory reform, infrastructure improvements and incentives for user-driven innovation.

Some examples of policy measures presented below in Table 20 (e.g. those related to legislation) concern more authorities at national and perhaps on EU level than on regional and local levels. However, most of the measures presented in Table 20 can be promoted also at the regional and local level.

Table 20. Roles of public authorities in promoting user-oriented innovation (Finnish Ministry of Employment and the Economy 2009; Wise & Høgenhaven 2008).

1. Knowledge and capability development
• Building knowledge institutions with specialised skills in the area of user involvement
• Research
o Attracting attention to the challenges caused by the change of focus from expert-centric to user-/citizen-centric innovation
o User-driven innovation in firms and other organizations
o Indicators of user-driven innovation
o Collection and description of additional company cases in order to better understand what methods can be used in which business contexts (and with what success)
o Quality checks (or standards) for living labs (and other co-creation environments)
o More detailed understanding on what approaches and business models can be appropriate to involve different types of users (including individual users, groups of consumers, customers, etc.)
• Education
o Users'/citizens' skills as demanding, responsible and participative consumers;
o Networking skills and the ability to identify opportunities to create value for the end user;
o An emphasis on cultural and design competencies;
o The creation, management and commercialisation of intellectual property in an open innovation environment.
• Methods and tools
o methods related to the gathering and utilization of user information
2. Regulatory reform
• Better utilization of public sector held data & user information
o Protection and privacy regulations
o Reuse of public sector information
• Collaboration with users
o Regulatory reform to empower citizens influence and ability to make choices
o Stimulus for partnerships in public service production
• Intellectual property
o Renewal of the institutional framework to make it more suitable and supportive for open and user-driven innovation
o More consistent regulation of the intangible value and liabilities resulting from user-driven innovation activities
3. Infrastructure improvements
• ICT infrastructure
o Open and interoperable ICT infrastructure supporting user-driven innovation especially within the public sector
• Development platforms & environments for public private partnership
o Creating collaboration between knowledge institutions and companies regarding innovation partnerships and user involvement
• Renewal of public sector services
o Applying user-driven innovation in welfare benefits and public services
4. Incentives for user-driven innovation
• Financial incentives
o New instruments for supporting user-driven innovation
o New financing criteria for existing instruments enabling better support for user-driven innovation
• Building user awareness and channels of influence
o Raising awareness of user-driven innovation among citizens, businesses and public sector
o Stimulus for user influence through empowerment and improved channels of influence

6.4.4. Summary of the roles offered to regional and local authorities

To conclude, there are numerous ways in which regional and local authorities can promote the QH. We have composed a summary of the different roles these authorities can have in supporting QH type of innovation activities. This summary is presented in Table 21. Into this summary we have included those roles and measures which are common to all QH innovation models taking the users and citizens as real partners of innovation co-operation.

Table 21. Summary of the different roles of regional and local authorities for promoting QH.

1. Enabler
• financier (e.g. through project funding, ownership, investments and public procurements)
• provider of infrastructure (incl. ICT infrastructure, building lots
2. Decision maker
• member of the steering group of QH innovation platforms
• maker of regional/local QH innovation policies (e.g. guidelines, financial incentives, R&D&I programmes supporting QH- and user-oriented innovation)
3. Supporter
• to support the development of QH partners (e.g. firms, universities, users, public organizations)
• to support the linking, networking and interactive learning of different groups and stakeholders (incl. collaboration with users)
• to support the systematic collection and utilization of user information (incl. public sector data)
• to support the knowledge and capability development related to QH (e.g. research, education, methods and tools)
• to promote the empowerment of citizens and to assist citizens in their innovation activities
4. Utilizer
• to utilize QH- and user-oriented development methods in the internal development work in public sector
• to utilize the user-oriented development services provided by QH innovation environments by themselves (as part of the development of public services)
5. Developer
• to develop public organizations so that they can function better and offer new and better products and services to their clients, to the citizens
• to renew institutional framework in order to make it more suitable for user-oriented innovation
6. Marketer
• to raise awareness of user-oriented innovation among citizens, businesses and public sector
• to market user-oriented innovation models and practices to businesses, users, other financiers
7. Quality controller
• to support the development of "quality checks" or standards for QH type of activities and for other co-creation environments
• to assess the quality of QH type of activities with the help of these standards

7. Conclusions

7.1. What is QH

Our first task was to go and look for the Quadruple Helix (QH) innovation model, does it exist and if it does, what does it consist of and how it can be defined. We can conclude that Quadruple Helix does exist, but as a concept it is not very well-established and widely used in innovation research and in innovation policy. The concept also has no well-established definition. We also find out that there exists not only one Quadruple Helix, but several different ones. What is common to all QH type of innovation conceptions is that they all have included some fourth group of innovation actors into TH model. Based on research literature concerning innovation and innovation policy, we argue that the fourth helix of QH should be a broadly understood user. Accordingly, Quadruple Helix can be seen as describing innovation co-operation between firms, universities, public organizations and users.

Based on that, we have formed a general definition of QH innovation model: it is an innovation co-operation model or innovation environment in which users, firms, universities and public authorities co-operate in order to produce innovations. These innovations can be anything which is considered useful for the partners of innovation co-operation, for example, technological, social, product, service, commercial, non-commercial, private sector and public sector innovations.

The user can be understood very broadly. Depending on the context, users can be businesses, organizations, civil society associations, lead users, professional users, ordinary or amateur users, consumers, employees, residents, citizens and hobbyists. Also in our QH research the user is defined and understood broadly. When the concept "user" is understood widely, then also the user-oriented QH innovation model is more widely applicable.

To conclude, the participation of the user in the innovation co-operation is what differentiates QH from TH. However, this kind of separation between these two concepts is not totally unambiguous and unproblematic. Firms and universities have used some kind of consumer and user research as part of their development work for a very long time. Therefore it is arguable that the users have been involved also in the Triple Helix type of innovation activities, even though their input is often left without explicit mention in the TH context. If and when some kind of user involvement has also been part of TH, then the line between TH and QH becomes like a line drawn on water.

In order to differentiate TH from QH, we have made a minimum requirement for user involvement related to QH innovation model. One can start to talk about user involvement related to QH when the information related to the user is collected and utilized systematically by the organizations doing the development work. Therefore user involvement in QH innovation model can range from the systematic collection and utilization of user information to the development of innovations by the users themselves.

In the innovation literature users and user involvement are often considered from the point of view of markets, firms and commercial activities. Users can also be considered as active citizens who are trying to have an effect on the decision making in private and public sectors and which concerns them. The role of users and user involvement may be even more complicated in the case of the introduction of the public sector. There are at least three perspectives to look at user/citizen involvement in the public sector. First, user can be seen as a consumer, who buys or is not buying the product/service produced by the public sector. Secondly, user can be seen as a collectivist, who

can have an effect on the public decision making through representative democracy or through direct democracy. Thirdly, user can be seen as an individual or a member of community. When she/he is seen as an individual, then she/he can be empowered by a) extending choices or clarifying services he/she is entitled to, b) giving means to complain, and c) providing equality and easy access. When she/he is seen as a member of community she/he can be empowered by giving direct control and right to determine issues affecting the community.

QH can be seen as a systematic way of pursuing user-oriented innovation. Quadruple Helix is a very wide and multidimensional concept referring to numerous different activities and actors. It seems that it is more reasonable to consider QH as a continuum or even as a space rather than a single model. Therefore it could be more meaningful to talk about good and useful QH models than about one best QH model. Different QH models are suitable for different purposes and contexts. In each case the QH model suitable for certain situation depends on various characteristics of innovation activity, for example, on the goals of innovation activity, on the context of innovation activity and on the initiator and owner of the innovation process.

In order to make some interesting dimensions and possibilities of QH explicit, we constructed four different types of QH models, 1) "TH + users" model, 2) "Firm-centred Living Lab" model, 3) "Public sector -centred Living Lab" model and 4) "Citizen-centred" model (see Figures 10, 11, 12 and 13). These models are ideal type innovation models and they are not meant for describing the reality as it is. The purpose of these models is to bring forward some essential characteristics of different QH models more clearly and to give examples of the application possibilities of QH type of innovation co-operation.

"TH + users" model (Figure 10) is otherwise same as the traditional TH model except for the systematic collection and utilization of user information. The focus is on the development of commercial high tech innovations, based on latest scientific research knowledge. The owner of the innovation process is a firm, group of firms, university or group of universities. In this model the degree of of user involvement could be characterizes as design for users. Users are treated as informants, not as developers.

In "Firm-centred Living Lab" model (Figure 11) the focus is also on the development of commercially successful innovations. They can be based on latest research knowledge, on new applications or combinations of "old" research knowledge and/or on user knowledge. The owner of the innovation process is a firm or group of firms. In this model users are treated both as informants and as developers. In other words, they also participate in the development work, for example, of new products and services together with R&D experts.

In "Public sector -centred Living Lab" model (Figure 12) the focus is on the development of public organizations and services. The owner of the innovation process is in this case some public organization or a group of public organizations. The goal of innovation activity is, above all, to develop public organizations so that they can function better and offer new and better products and services to their clients, to the citizens. In order to succeed in this public organizations have to gather systematically information and feedback from the clients. This can be realized with the help of more traditional information gathering methods (e.g. surveys, interviews), or by organizing dialogue forums (virtual and real) for citizens. Also in this model the users participate in the development work of public services together with R&D experts.

In "Citizen-centred QH" model (Figure 13) the focus is on the development of innovations relevant for the citizens. In this innovation model citizens are in the driver's seat. Owner of the innovation process is a citizen or a group of citizens (i.e. a development community). In this model the degree

of user involvement could be characterized as design by users, i.e., new products, services and ways of doing things are developed by the users (see Chapter Defining user and user involvement). Besides making most of the development work, citizens also decide which kinds of innovations are needed and developed. The role of firms, public authorities and universities is, above all, to support citizens in their innovation activities (e.g. to provide tools, information, development forums and skills needed by users in their innovation activities). Firms and public organizations also utilize the innovations made by the citizens.

From these four QH models presented here the first two (TH + users and Firm-centred Living Lab) seem to be very much reality already today in several countries. Public sector –centred Living Lab model seems also to be in use at least in different projects related to the development of public services. At the moment Citizen-centred QH model is most likely the most infrequently utilized model of these four QH models. It provides the biggest challenges to firms, universities and public authorities, who are not used to give the steering wheel/driver's seat to the citizens in innovation activities. As a genuine bottom-up model it is also the most difficult innovation process to manage from the point of view of the public authorities.

7.2. The relevance and usefulness of QH

As a model of innovation QH is relatively young and not very widely used. It is also an innovation model which is under-researched and under-documented. This makes the assessment of the relevance of this model at the very least challenging. However, based on the user-oriented innovation literature and on the living lab literature (incl. living lab cases) we argue that QH as an innovation perspective and model(s) provides important additional value to innovation research and policy.

The reviewed living lab cases demonstrated that QH type of innovation co-operation and environment can produce innovations, which are relevant for the users and beneficial also to businesses and public organizations. These cases also illustrated that QH type of innovation environments can support firms, especially SMEs, and public organizations in developing user-oriented innovations.

It seems also that QH has wide application possibilities. QH has been applied both in the private and in the public sector and in several operational areas, including telecommunication, health, well-being, housing, tourism, energy, and governance. In addition to innovation, this concept plays also other roles, for example, in entrepreneurship and venturing, in technology transfer, in promotion and development of cities and regions. QH development platforms and environments could be seen as a supplement to traditional cluster and regional innovation policy and as a new kind of intermediary organization, which supports the involvement of users in the R&D&I activities.

When the user- or citizen-involvement methods are used in public sector, the public sector specific barriers to innovation and user-involvement have to be taken into consideration. Examples of them are the following (Borins 2001, Mulgan & Albury 2003, Brand 2005):
- Delivery pressures and administrative burdens
- Short-term budgets and planning horizons
- Poor rewards and incentives to innovate
- Culture of risk aversion
- Poor skills in active risk or change management
- Reluctance to close down failing programmes or organisation

- Constraining cultural or organisational arrangements (incl. bureaucracy)
- Lack of user orientation and skill to utilize user involvement

Despite these differences, public entities, like companies, also hope that their "products" meet the needs and acceptance of their citizens – be they traffic infrastructures, safety measures, waste collection schemes, or public transport systems. If they succeed, people will adopt them into their daily routines in the sense intended by the "designers," i.e. politicians, planners, etc. But in the case they fail, unlike in the context of consumer products, citizens cannot simply modify public policies or infrastructures and they cannot simply create a prototype of their ideal, for example, traffic system. But they can vote with their ballot and with their feet. Currently the role of citizens in policy and infrastructure design processes is usually confined to commenting or voting on preconceived drafts and plans. Citizens are, in other words, often consulted after the arrow has left the bow. But citizen-involvement methods could be used more often in the early preliminary stages of public design and policy making processes, even though the inclusion of citizens in the process of administration often clashes with a specialized, routine-oriented, hierarchical, and impersonal bureaucracy. Research has shown that there are clear benefits to the inclusion of citizens in the performance of public authorities (Holzer & Kloby 2005). (Brand 2005)

But one should also recognize that the motivation of users to participate in the development work can be even more challenging in the public sector than it is in private sector. In motivating users to participate in the development work of public sector, the following motivational factors or principles of motivation should be taken into consideration (see Airong & Chiang 2008).

1. *The principle of justice and justness*
   - Justice and justness is a very important principle of motivation mechanism. Users/citizens must treated so that they do not experience that they have been treated unfairly.
2. *The principle of instant*
   - Users/citizens should be responded quickly and the co-developed measures implemented quickly.
3. *The principle of transparency*
   - The decision making and implementation processes of co-developed measures should be open and transparent.
4. *The principle of flexibility*
   - Public authorities should be able to take into consideration the diversity of citizens' needs and characteristics. Public authorities should also be able to respond to changes in the needs and opinions of citizens.

One of our research tasks was to find out if the QH can bridge the innovations gaps between civil society and innovation. Innovation gap in this context can mean "technological innovation gap", the "trust /moral gap" and "public sector innovation gap" Technological innovation gap means the insufficient capability of European firms for translating their technological knowhow into successful business cases with significant commercial and societal impacts. Trust gap/moral gap means that citizens do not necessarily trust the break trough technologies developed by firms and public research organizations or they can consider these technologies and the use of then unethical or un-ecological. Public sector innovation gap can mean the insufficient capability of local, regional and national authorities to involve citizens into the development of public services and organizations.

Our research indicates that user-oriented QH model has potential to bridge, or at least, narrow down all these innovations gaps. The reviewed living lab cases demonstrated that with the help of QH

model both firms and public organizations can develop products and services which really interest consumers, users and citizens. How much this potential of QH will be actually realized, and how well this innovation model can succeed in narrowing down also other innovation gaps, besides the technology gap, depends on lots of things. It depends, for example, on how much power of influence firms and public authorities are willing to give to the users/citizens and on how much power of influence the users/citizens are willing and able to take. Because of the scarce of research concerning this topic there is not very much more to say about this topic at the moment. Power seems to be a sensitive subject in innovation literature. Therefore it is not surprising that this topic is not addressed in QH literature either, even though there is a clear in build tensions or even conflicts of interest included in the user-oriented QH innovation activities: how much decision making power is delegated from firms, universities and public organizations to the user and how the benefits of user-oriented innovations are shared between the firms, public organizations, universities and users.

The QH model contains a clear possibility and threath that user will be exploited and promised too much. How much influence the user can have and how much the user can benefit from the QH model depend very much from the skills and knowledge of the user and how active she/he is. In other words, QH gives possibilities to those users who want to and are able to participate and utilize QH innovation. One way to prevent users from being exploited is to make some kind of rules and regulations concerning, firstly, the division of benefits related to QH innovation (how much different partners of QH innovation co-operation, including the user, should benefit from this co-operation) and secondly, sustainable and fair utilization of the user in QH innovation (i.e. rules guaranteeing that the users are not exploited in QH innovation process).

Without a doubt QH has also its limitations. One factor limiting or at least slowing down the diffusion of this model is the fact that there are numerous challenges related to the transition from old research-/technology driven innovation models (incl. the TH model) to more user-oriented innovation models. Some of these challenges are more connected with enterprises, others with universities, public organizations and users. We have gathered some of these challenges into the Table 22.

Table 22. Challenges related to the transition from research-, technology- and R&D expert driven innovation models to QH models

Firms
• May necessitate a development of new business models.
• Necessitates a huge change of culture, the R&D experts and managers of firms have to give up some of their decision making power to the users/consumers/citizens and apply user-oriented approaches instead of technology or expert -oriented approaches.
• Also the roles of firms' R&D experts may have to be changed, earlier they were the ones who knew best what is worth doing, in QH model also the users know this, R&D –experts may have to become also supporters of user innovations instead of just the makers of R&D expert innovations.
• Necessitates new skills and methods to find the right users, to co-operate with users, to motivate them and to utilize the input of users. Therefore QH model can be more easily applied by firms having better financial resources and therefore better ability to acquire more QH knowhow and expertise.
• User involvement, especially in several phases of innovation, is also a time consuming task, smaller companies may have difficulties to find enough resources to do this (even though it can lessen the risks associated with the development new products).
• User-oriented innovation models can be more easily applied by firms which produce products/services for the end users and consumers and therefore operate in areas in which innovation is more driven by the end-users (IT, mobile technologies, media and health care).
• User-oriented innovation models can also be more easily applied by firms which operate in markets in which the competing products/services are developing fast.
• Appliance of user-oriented innovation models can be easier for larger firms, where users have long been actively involved in product and services development (for example firms having strong brands or operating in the IT sector).
• For SMEs the advantages of "user-driven" innovation can be less obvious and more difficult to grasp.
Universities
• Also R&D experts working in universities have to give up some of their decision making power to the users/consumers/citizens and apply more user oriented approaches instead of too technology or expert oriented approaches.
• The roles of R&D experts working in universities have to change also, they role is no longer just to produce scientific knowledge which then can be utilized by the developers of technology. They role is also to support users as they participate in innovation processes and are doing development work on their own. In other words, also R&D experts working in universities may have to become a supporters of user innovations instead of just the makers of R&D expert innovations.
Public organizations/authorities
• Innovation policy measures expected from the public authorities may increase significantly. After this transition, in addition to measures supporting the development of TH environments, they should implement also measures supporting the development of different QH environments.
• QH is a under-researched and under-documented topic, therefore public authorities do not have enough reliable information about QH and good policy measures related to this model.
• Open/citizen centred innovation is in contradiction with top-down and bureaucratic practices of public organizations.
• Necessitates a huge cultural change and also changes in the official regulations of public organizations.
• May necessitate new public service models (citizen-driven models).
• Necessitates new skills and methods at all levels in the public sector.
• Different sectors of business may necessitate different incentives and support mechanisms. For example, sectors in which the innovation is driven by the end-users, differ in this respect from sectors in which innovation is more dominated by business-to-business relations or public procurement.
• Policies and measures for supporting user-oriented QH innovation are only in their infancy.

Table 22. continues.

Users/citizens
• Necessitates new skills and know-how from the citizens.
• Those who already have better skills and know-how, related, for example, to web-based development tools, have more possibilities to have an influence on products/services to be developed.
• Citizens have to be active, those who are not active are easily excluded from QH processes.
• Citizens have to be aware of their possibilities of influence.
• Citizens have to be aware of their rights (otherwise they could be exploited by firms and public organizations utilizing their ideas).

7. 3. How public authorities can promote QH

We have now concluded that QH is a relevant and useful model. But how the regional and local authorities can promote the diffusion and appliance of this model? As we can see from the Table 22 above, the user involvement can offer, besides one of the biggest possibilities to the innovation activity of firms and public organization, also at the same time, one of the biggest challenges related to the implementation and diffusion of these models. One thing that regional and local authorities can do is to support and assist firms, universities, users/citizens and public organizations/authorities to meet and solve those challenges presented in Table 22. Our study demonstrated that there are several ways in which these authorities can support and assist QH actors to meet these challenges and to implement QH innovation models. In Chapter 6.4. "The roles of regional and local authorities in promoting QH" we made a summary of the different roles these authorities can take in order to support QH type of innovation activities (see Table 21). A condensed version of this summary is presented in Table 23 below. Into this summary we have included roles and measures relevant to all QH innovation models considering the users and citizens as real partners of innovation co-operation.

Table 23. Summary of the different roles of regional and local authorities for promoting QH.

1. Enabler
• e.g. financier and provider of infrastructure
2. Decision maker
• e.g. maker of regional/local QH innovation policies (e.g. guidelines, financial incentives, R&D&I-programmes supporting user-oriented innovation)
3. Supporter
• e.g. to support the development of QH partners (e.g. firms, universities, users), the systematic collection and utilization of user information and the knowledge and capability development related to QH, to promote the empowerment of citizens and to assist citizens in their innovation activities
4. Utilizer
• to utilize the user-oriented development services provided by QH innovation environments by themselves (as part of the development of public services)
5. Developer
• e.g. to utilize user-oriented development methods in the internal development work public sector
6. Marketer
• e.g. to raise awareness of user-oriented innovation models and practices among citizens, businesses and public sector
7. Quality controller
• e.g. to support the development of "quality checks" or standards for QH type of activities and for other co-creation environments and to assess the quality of QH type of activities with the help of these standards

As we have already learned from Chapter 6.4. "The roles of regional and local authorities in promoting QH", the roles of public authorities are somewhat different in different QH models. Therefore, in addition to these general measures presented above, public authorities should also use QH model specific measures.

8. Recommendations

The recommendations, suggestions and guidelines of this chapter are given with local and regional authorities in mind vis-à-vis the four QH models identified by the research.

In the short term the examples of good practice addressing the different aspects of user-centric innovation can directly serve as learning material for the actors in the region. We recommend studying it and further exploring it, according to the particular needs and interests of the actors in the respective regions.

But as it was identified in the conclusions and also by the CLIQ partners in their reflective comments on the QH cases, the shift to citizen and user orientation is, at the end of the day, a big cultural change, not just a small operation - be it in the public or private regime - and must be underpinned with many different aspects and skills in order to be robust and sustainable.

Local and regional authorities have an important role in QH, via strategic use of resources, integrating knowledge and skills in innovative thinking, community building, procurement and regulation, grants, rewards – but they also have big needs for their own ability and skills development, and many constraints in terms of inflexibilities and bureaucracies. This means that the public authorities are faced with a double challenge: renewing themselves in order to be able to be an interesting partner in renewing the local-regional "innovation ecosystem". One could say that in the long term we need a shift to "Public Authority 2.0" in order to be a seminal partner in the "Innovation Ecosystem 2.0". How far each and every local and regional authorities are in this shift, and how far is the innovation ecosystem around it, of course varies.

A stepwise process, which is relevant for the context, of building awareness, connection, learning and mutual trust-building is advisable, and here the four QH models and the wealth of experiences already contained in relation to them, could be helpful.

We recommend that each locality/region identifies their particular stage of development, challenges and opportunities with the help of the four basic QH models and the good practices identified in them, and designs and executes, together with the necessary stakeholders, a local-regional learning process, with a distinction of a short term and a long term opportunity perspective. Thus, we recommend making a careful self-assessment against the different QH-models, goals, types of innovations produced, and the roles, skills and activities needed from the public authorities to support innovation.

In the research results we identified four basic QH models, (1) Triple Helix + users, (2) Firm-centred Living Lab model, (3) Public sector –centred Living Lab model and (4) Citizen-centred models.

The fours models could be treated as potential possibilities for innovation development in the region. In this sense each model could serve as a "thematic tool" to first explore the situation, and then move to design an innovation network action plan and its execution.

Figure 15. Local-regional public authorities and the four basic QH-models.
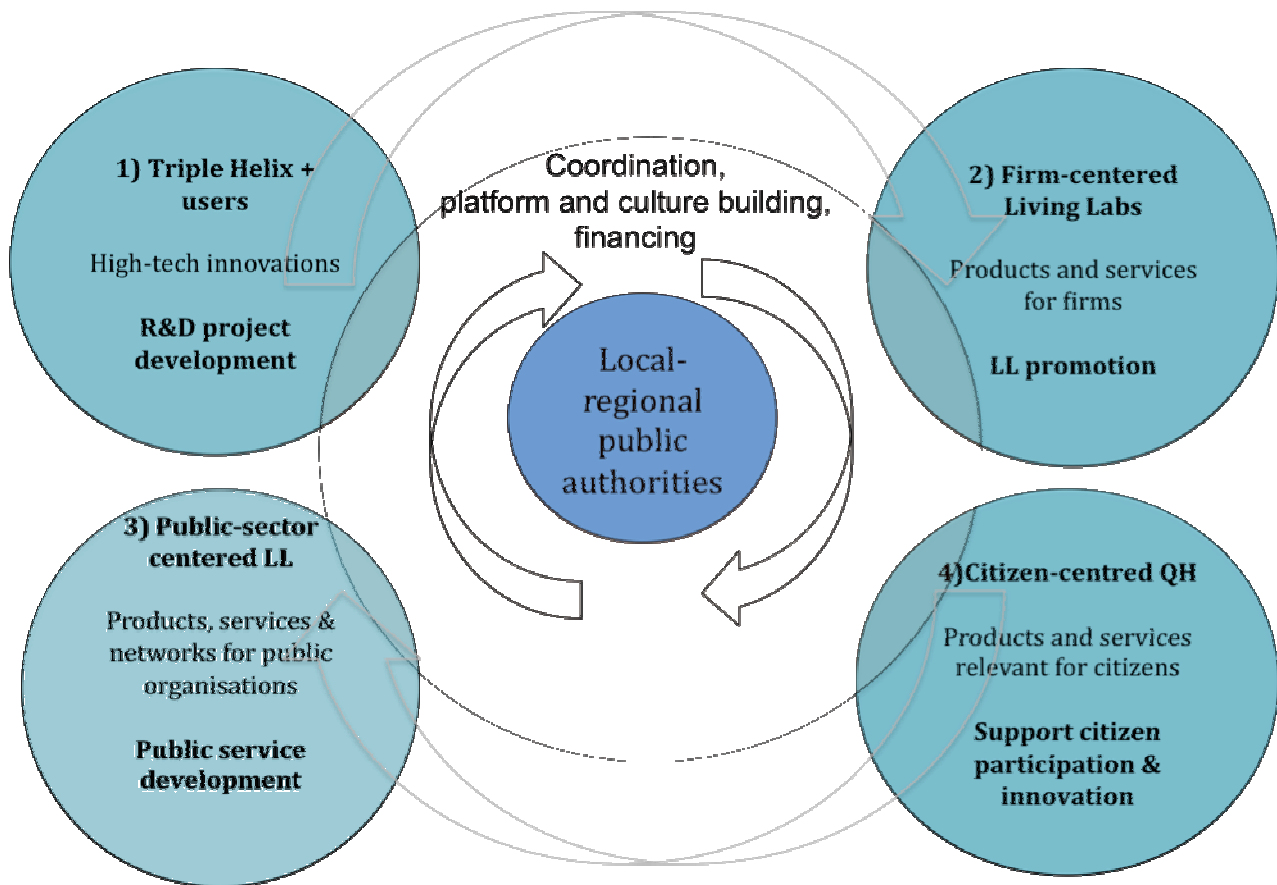
We don't believe that a linear developmental model of first building and securing a Triple Helix model and then moving, in a linear fashion, to more and more radical departures from it, is called for. Rather, the reality in the various contexts probably is that there is a mixture of all these models - some further than others, some in an incipient stage, some more mature - existing or available for the regions. This is apparent also among the CLIQ partners. Likewise, the existing structures and prevailing practices and skills in the region provide different opportunities to address this hybrid and non-linear situation.

For public authorities promoting the Triple Helix + users model means mainly supporting the development of high-tech firms with the help of firm-industry R&D projects and financing.

To promote Firm-Centred Living-Lab type of activities means first and foremost supporting network-building of LL actors and promoting the development and diffusion of LL.

Promoting Public-Sector Centred Living Lab kinds of activities means supporting the development of public service development.

Promoting Citizen-centred QH development means facilitating citizen innovations, informing and promoting participation, developing decision making interfaces and building individual capabilities.

This is description from a 'primary task' perspective, but there is overlap in the roles and means concerning the different models, and they can be mutually supportive.

The conceptual analysis in Chapter 3 and the cases in Chapter 4 offer insight and examples of promoting innovation in this hybrid field of opportunities.

Overall, the role offered for regional and local authorities is providing coordination and building platforms and forums for the dialogue, participation and co-production, and of course the more traditional role of financier or co-financier. In terms of promoting participation, co-production and building forums and platforms for dialogue there is a wealth of approaches and methods to tap into, like the family of various dialogical and multi-stakeholder work-conference methods and community building (Reason and Bradbury 2000, Emery and Purser 1996, Gustavsen 2002, Conklin 2006, Wenger 1998, among others), and also a rich discussion on the development of co-production concerning the public services (f.ex. Boyle and Harris 2009).

Each QH type has its main goals, initiators, and types of innovation it aims to produce. Against these the public authorities have different roles and sets of skills and practices needed to fulfil the partly overlapping and mutually supportive roles. We believe that in order to move ahead in user-centred innovation, and to establish a solid learning region in innovation, progress in the longer run is needed in all the QH types, so that the different actors – scientific and business communities, public authorities and citizens – continue to move ahead in mutually supportive co-operation.

In table 24 a synoptic view of the QH types, corresponding goals and roles, practices and skills needed in innovation promotion for public authorities is provided. The same table – mutatis mutandis - could be used for a synoptic assessment of the present status of QH type innovation development in the region and for goal setting for further development.

Table 24. Synoptic view of QH-types and corresponding goals, roles and skills needed in innovation promotion

QH-type	Goal of innovation activity	Type of innovation	Role of public authorities	Key skills , practices and tools needed for public authorities
Triple Helix + users model	Produce commercially successful high tech products and services	High tech and radical innovations	Support high tech firms, university research, financing	Contacts to research, project and financing skills and tools
Firm-centred Living-Lab model	Produce products and services for firms and their clients	Commercially exploitable technological and social innovations, public sector innovations, incremental and radical	Supporting development and networking of LL actors, support user involvement, develop public services	Product development, learning network and dialogue forum building skills and tools
Public-sector centred Living labs	Produce products and services relevant for public authorities and users of public services	Public sector innovations; commercially exploitable technological and social innovations	Support user/ citizen involvement, public sector development, promote LL provide information on users. Offer dialogue forums to users and forums to participate in decision making	Learning network and information infrastructure building for regional/local organisations
Citizen-centred Quadruple Helix	Produce products and services relevant for citizens	Innovations relevant for citizens	Offer information, training and tools needed by citizens in their innovation activities	Facilitation, individual capability and community building

The first step of course, is being aware of the particular challenges, opportunities and gaps existing in one's locality, against the models described here, and identifying the roles public authorities can play in these. Further steps include building a multi-stakeholder learning network and forums to debate these findings and set further goals and to make an inventory of existing practices and tools against these findings and goals. The QH practices presented in this research report can provide material and gateways to further identify the possibilities, practices and routes for further action.

Regional and local authorities could engage lead users in innovation processes by providing financial incentives to the end-users to cooperate with local firms. This is still a widely untapped area. They could, for example, issue innovation vouchers funded by regional development and innovation agencies to end-users, with the view of testing innovative solutions developed by cluster firms. This may be a promising approach, in particular in areas requiring high investments such as energy efficiency or construction.

Another promising approach to support "user-driven" innovation is the pre-commercial public procurement, where public authorities enter into direct relationships with enterprises to find innovative solutions to pertinent problems (Directorate-General for Enterprise & Industry 2009).

References

Airong, Z. & Chiang, G. (2008). Study on motivation mechanism of citizens' participation under the conditions of e-government. International Conference on Management of e-Commerce and e-Government.

Almirall, E. & Wareham, J. (2008). Living Labs and Open innovation: Roles and applicability.The Electronic Journal for Virtual Organizations and Networks, Vol. 10, "Special issue on Living Labs".

Asheim, B., Isaksen, A., Nauwelers, C. & F. Todling (2003) (eds.). Regional Innovation Policy for Small-Medium Enterprises. Cheltenham: Edward Elgar.

Asheim, B. (2007). Differentiated Knowledge Bases and Varieties of Regional Innovation Systems. The European Journal of Social Sciences, Vol. 20 Issue 3, p223-241,

Ballon, P., Pierson, J. and Delaere, S. (2005). "Test and experimentation platforms for broadband innovation: examining European practice", Conference Proceeding of ITS 16th European Regional Conference (Interna-tional Telecommunications Society), Porto, Portugal, 4-6 September.

Bekker, M. & Long, L. (2000). User Involvement in the Design of Human-Computer Interactions: Some Similarities and Differences between Design Approaches. McDonald, S. & Cocton, G., HCI2000: People and Computers XIV, pp. 135-146.

Bergvall-Kåreborn, B., Holst, M. & Ståhlbröst, A. (2009). Concept Design with a Living Lab Approach. Proceedings of the 42nd Hawaii International Conference on System Sciences)

Brand, R. (2005). The citizen-innovator. The Innovation Journal: The Public Sector Innovation Journal, Volume 10 (1).

Borins, S. (2001). The Challenge of Innovating in Government, The PricewaterhouseCoopers Endowment for The Business of Government.

Boyle, D. and Harris, M. (2009). The Challenge of Co-production – How equal partnership between professionals and the public are crucial to improving public services. New Economics Foundation. Discussion Papers. http://www.neweconomics.org/publications/challenge-co-production

Boxall, P. and J. Purcell (2003). Strategy and Human Resource Management. Houndmills: Palgrave Macmillan.

Chesbrough, H. (2003). Open innovation: the new imperative for creating and profiting from tech-nology. Boston, Mass: Harvard Business School Press.

Clarke, M. & Stewart, J. (1992). Citizens and Local Democracy, Empowerment: a Theme for the 1990s. Local Government management Board: London.

Conklin, J. (2006). Dialogue Mapping – building shared understanding of wicked problems. Chichester: John Wiley & Sons Ltd.

Cooke, P. (1998). Introduction: origins of the concept. In Brazyk, H., Cooke, P. & Heidenreich, M. (eds.), Regional innovation systems. UCL Press, pp-2-25.

Cooke, P., Heidenreich, M. & H.-J. Braczyk (2004). Regional Innovation Systems. The role of governances in a globalized world. Edited by Philip Cooke and Martin. Heidenreich. UCL Press.

Dibben, P. & Bartlett, D. (2001). Local Government and Servive Users: Empowerment through User-Led Innovation. Local Government Studies, Vol. 27, pp. 43-58.

Di Gangi, P., M. & Wasko, M. (2009). Steal my idea! Organizational adoption of user innovations from a user innovation community: A case study of Dell IdeaStorm. Decision Support Systems, Vol. 48, pp. 303–312.

Directorate-General for Enterprise & Industry (2009). Fostering user-driven innovation through clusters. Draft discussion paper prepared by DG ENTR-Unit D2 "Support for innovation". Available on www.proinno-europe.eu.

Eason, K (1987). Information Technology and Organizational Change. London: Taylor and Francis.

Edquist, C. (1997). Introduction. In Edquist (ed.) Systems of Innovation. Technologies, Institutions and organizations. London and Washington: Pinter Publishers / Casell Academic, 1997: 1-35.

Edquist & Hommen (1999). Systems of innovation: theory and policy for the demand side. Technol-ogy in Society 21, 63-79.

Edguist, C., Luukkonen, T. & Sotarauta, M. (2009). Broad-Based Innovation Policy. In Evaluation of the Finnish National Innovation System – Full Report. pp. 11-69, Taloustieto Ltd, Helsinki

Emery, M. and Purser, R.E. (1996). The Search Conference: Theory and Practice. San Francisco. Jossey-Bass.

Enterprise & Industry Directorate General (2009). Fostering user-driven innovation through clusters. Draft discussion paper prepared by DG ENTR-Unit D2 "Support for innovation". Available on www.proinno-europe.eu.

Eriksson, C. I. & Svensson, J. (2009). Co-creation in Living Labs Experiences from Halmstad Living Lab. Retrieved from http://owela.vtt.fi/cocreation/2009/05/22/experiences-from-halmstad-living-lab on 17th January 2010.

Eriksson, M., Niitamo, V-P. & Kulkki, S. (2005). State-of-the-art in utilizing Living Labs approach to user-centric ICT innovation – a European approach. Retrieved from http://www.vinnova.se/upload/dokument/Verksamhet/TITA/Stateoftheart_LivingLabs_Eriksson2005.pdf on 12. august 2009

Etzkowitz, H. (1998). The norms of entrepreneurial science- cognitive effects of the new university-industry linkages. Research Policy, no. 27, Vol. 1, pp. 823-833.

Etzkowitz, H. (2002). MIT and the Rise of Entrepreneurial Science. London: Routledge.

Etzkowitz, H. (2003). Research groups as 'quasi-firms'. The invention of the entrepreneurial university. Research Policy, No. 31, Vol. 1, pp. 109-121.

Etzkowitz, H. & Klofsten, M. (2005). The innovating region: toward a theory of knowledge-based regional development. R&D Management, vol. 35 Issue 3, p243-255.

Finnish Ministry of Employment and the Economy (2009). Demand- and user-driven innovation policy framework. Available on http://www.tem.fi/files/25688/Policy_framework090604.pdf.

Friedland, C., Merz, D. & Van Rensburg, J. (2008). Networked micro-enterprises: the added value of collaborative procurement in rural South Africa. Paper presented in IST Africa 2008 Conference.

Følstad, A. (2008). Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. The Electronic Journal for Virtual Organizations and Networks. Vol. 10. "Special Issue on Living Labs".

Gustavsen, B. (2002). Constructing New Organisational Realities – The Role of Research. Concepts and Transformation, vol. 7 (3) : 237-261.

Guzmán, J., G., Schaffers, H. & del Carpio, Á, F. (2009). Assessment of Results and Impacts of the C@R Rural Living Labs. The Electronic Journal for Virtual Organizations and Networks, Vol. 11.

Harhoff, D. & Mayhofer, P. (2010). Managing User Communities and Hybrid Innovation Processes: Concepts and Design Implications. Organizational Dynamics, Vol. 39, No. 2, pp. 137–144.

Hogget, P. & Hambleton, R. (eds.) (1987). Decentralisation and Democracy: Localising Public Ser-vices. School for Advanced Urban Studies: Bristol.

Holzer, M. & Kathryn, K. (2005). Sustaining Citizen-Driven Performance Improvement: Models for Adoption and Issues of Sustainability. The Innovation Journal: The Public Sector Innovation Journal Volume 10(1).

Hood, C., & Rothstein, H. (2000). Business risk management in government: Pitfalls and possibilities. Published as Annex 2 in Supporting Innovation: Managing risk in government departments, HC 864, 17 August 2000. NAO, London.

Kaulio, MA. (1998). Customer, Consumer and User Involvement in Product Development: A Framework and a Review of Selected Methods. Total Quality Management 9 (1) 141-150.

Kline, SJ & Rosenberg, N. (1986). An Overview of Innovation. In: Landau, R. & Rodenberg, N. (eds.). The positive sum strategy. Washington: National Academy Press, 1986: 275-304.

Kristensson, P., Gustafsson, A. & Archer, T. (2004). Harnessing the Creative Potential among Users. The Journal of Product innovation Management. Vol, 21, pp. 4 – 14.

Lettl, C. (2007). User involvement competence for radical innovation. Technology Management, Vol. 24, pp. 53-75.

Leydesdorff, L. & Meyer, M. (2006). Triple Helix indicators of knowledge-based innovation systems: Introduction to the special issue. Research Policy, No. 35, Vol. 10, pp. 1441-1449.

Liljemark, T. (2004). Innovation Policy in Canada. Strategy and Realities. Swedish Institute for Growth Policy Studies. Stockholm.

Ling, T. (2002). 'Innovation: lessons from the private sector: a 'think piece' in support of the invest to save study', Unpublished Cabinet Office.

Lundvall, B-Å. (ed.) (1992). National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Pinter.

Lundvall, B-Å., - Johnson, B. - Andersen, E., S. & Dalum, B. (2002). National systems of production, innovation and competence building. Research Policy no. 31. pp. 213-231.

MagGregor, S., Marqués, P., Simon, A., Bikfalvi, A. & Llach, J. (2009). QLIQboost. Baseline re-search for QLIQ INTERREG IVC (Creating Local Innovations for SMEs through a Quadruple He-lix) presented by the University of Girona to the City of Jyväskylä. Final report.

Magnusson, P., R., Matthing, J. & Kristensson, P. (2003). Managing User Involvement in Service Innovation. Experiments With Innovating End Users. Journal of Service Research, Volume 6, No. 2, November 2003, pp. 111-124.

Mertz, C., Friedland, C., de Louw, R., Dörflinger, J., Maritz, J., van Rensburg, J. & Naudé, A. (2009). Sekhukhune: A Living Lab Stimulating Economic Growth of Rural Micro-Enterprises in South Africa. The Electronic Journal for Virtual Organizations and Networks, Vol. 11.

Moulaert, F. & Sekia, F. (2002). Territorial Innovation Models: A Critical Survey. Regional Studies, vol. 37:3, pp. 289-302.

Mulgan, G. and Albury, D. (2003). Innovation in the Public Sector, Strategy Unit, Cabinet Office.

Ozer, M (2009). The roles of product lead-users and product experts in new product evaluation. Research Policy, Vol. 38, pp. 1340–1349.

Olson, E., L. & Bakke, G. (2004). Creating breakthrough innovations by implementing the Lead User methodology. Telektronikk, No. 2.

Orava, J. (2009). Living Lab –toiminta Suomessa (Living Labs –activities in Finland). Network publication of the Finnish Regional Centre Programme, 3/2009. Vaasa.

Pascau, C. & van Lieshout, M. (2009). User-led, citizen innovation at the interface of services. European Communities, Vol. 11, No. 6, pp. 82-96.

Pascau, C. & van Lieshout, M. (2009). User-led, citizen innovation at the interface of services. European Communities, Vol. 11, No. 6, pp. 82-96.

Pettigrew, A.M., Whittington, R., Melin, L., Sánchez-Runde, C. F., van den Bosch, A.J., Ruigrok, W. & Numagami, T. (eds) (2003). Innovative Forms of Organizing: International Perspectives. London – Thousand Oaks – New Delhi: Sage Publications.

Piirainen, T. & P. Koski (2004). Integrating workplace development policy and innovation policy. A challenging task. Experiences from the the Finnish workplace development programme. In Fricke, Werner and Totterdill, Peter: Action Research in Workplace Innovation and Regional Development. John Benjamins, Amsterdam.

Reason, P. and Bradbury, H. (eds.) (2000). Handbook of Action Research.- Participative Inquiry and Practice. SAGE. London.

Rosted, J. (2005). User-driven innovation. Results and recommendations. Fora. Copenhagen.

Rönka, K. & Orava, J. (2007). Kehitysalustoilla neloskierteeseen. Käyttäjälähtöiset living lab- ja testbed innovaatioympäristöt. Tulevaisuuden kehitysalustat –hankkeen loppuraportti (in english On development platforms to quadruple helix. User-driven living lab and testbed innovation environments. Final report of Future development platforms –project.) Helsinki.

Santoro, R. & Conte, M. (2009). Living Labs in Open Innovation Functional Regions. White paper. Retrieved from http://www.ami-communities.eu/wiki/AMI%40Work_on-line_Communities on 10th March 2010.

Schaffers, H & Santoro, R. (2010). Living Labs and Open Innovation Policy in Regions for The Benefit of SMEs. Position paper to the Workshop of CO-LLABS Thematic Network on 27th January 2010, Brussels. Retrieved from http://www.ami- communities.eu/pub/ on 8th March 2010.

Schienstock, G. & T. Hämäläinen (2001). Transformation of the Finnish innovation system: A net-work approach. Sitra. Reports series 7. Helsinki: Sitra.

Selwyn, N. (2003). Apart from Technology: Understanding People's Non-Use of Information and Communication Technologies in Everyday Life. Technology in Society, Vol. 25, No. 1, pp. 99-116.

Ståhlbröst, A. (2008). Forming Future IT – The Living Lab Way of User Involvement. Doctoral Thesis. Luleå University of Technology.

Svensson, J. & Eriksson, C. I. (2009). Open Innovation in Small Enterprises – a Living Lab Approach. Re-trieved from http//:hh.diva-portal.org/smash/get/diva2:240015/FULLTEXT01 on 19th January 2010.

Svensson, J., Ihlström Eriksson, C. & Ebbeson, E. (2010). User Contribution in Innovation Processes – Re-flections from a Living Lab Perspective. Proceedings of the 43th Hawaii International Conference on System Sciences.

Thomke, S. & von Hippel, E. (2002). Customers as Innovators: A New Way to Create Value. Harvard Business Review, April.

Torkkeli, M, Hilmola, O-P., Salmi, P., Viskari, S., Käki, H., Ahonen, M. & Inkinen, S. (2007). Avoin innovaatio: Liiketoiminnan seitinohuet yhteistyörakenteet (In English: Open Innovation: the thin co-operation structures of business). Lappeenrannan teknillinen yliopisto, Kouvolan tutkimusyksik-kö. Tutkimusraportti Nro. 190. Lappeenranta.

van Velsen, L., van der Geest, T., ter Hedde, M. &, Derks, W. (2009). Requirements engineering for e-Government services: A citizen-centric approach and case study. Government Information Quarterly, Vol. 26, pp. 477–486.

Wenger, E. (1998). Communities of Practice – Learning, Meaning and Identity. Cambidge University Press.

Whittington, R. and A.M. Pettigrew (2003). 'Complementaries Thinking', pp. 125-132 in A.M. Pettigrew, R. Whittington, L. Melin, C. Sánchez-Runde, F.A.J. van den Bosch, W. Ruigrok and T.

Viljamaa, K., Lemola, T., Lehenkari, J. & Lahtinen, H. (2009). Innovaatiopolitikan alueellinen ulottuvuus. Katsaus viimeaikaisiin kehityssuuntiin (The regional dimension of innovation policy. Review of recent trends). Työ ja elinkeinoministeriön julkaisuja. Innovaatio, 22/2009. Edita Publishing Ltd.

Wise, E. (2008). Introduction. In Wise, E. & Høgenhaven, C. (eds.) User-Driven Innovation. Contex and Cases in the Nordic Region. Nordic Innovation Centre.

Wise, E. & Høgenhaven, C. (eds.) (2008). User-Driven Innovation. Contex and Cases in the Nordic Region. Nordic Innovation Centre.

von Hippel, E. (1986). Lead users: A Source of Novel Product Concepts. Management Science Vol. 32, pp. 791-806.

von Hippel, E., Thomke, S. & Sonnack, M. (1999). Creating Breakthroughs at 3M.

von Hippel,E. (2001). Perspective: User Toolkit for Innovation. The Journal of Product Innovation Management, Vol. 18, pp. 247-257.

von Hippel, E. (2005). Democratizing Innovation, MIT Press, Cambridge, MA. Available at SSRN: http://ssrn.com/abstract=712763.

Yawson, R.M. (2009). The Ecological System of Innovation: A New Architectural Framework for a Functional Evidence-Based Platform for Science and Innovation Policy The Future of Innovation Pro-ceedings of the XXIV ISPIM 2009 Conference, Vienna, Austria, June 21-24, 2009