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Abstract Living labs which provide research and development environments for innovative eCustoms solutions for cross-border trade have recently received a lot of attention and have provided rich grounds for research (Tan et al., 2006, Kartseva et al, 2006; Liu et al., 2006; Baida et al., 2008; Baida et al., 2007; Liu et al., 2007; Razmerita & Bjorn-Anderson, 2007; Frößler et al.2007; Rukanova et al., 2007). Two studies (Frößler et al., 2007 and Rukanova et al., 2007) on Living Labs are particularly relevant from the point of view of innovation development and adoption. While these earlier studies zoom in on specific aspects of the innovation processes related to the Living Labs (i.e. management or adoption), they do not provide a holistic understanding of the innovation process that takes place and how a specific phase forms part of the whole process. The goal of this paper is to bring such holistic understanding of the innovation processes that take place in the context of Living Labs. To do so, we make use of the innovation-development processes of Rogers (1995) and we apply them to analyze the setting of Living Labs. In our analysis, we further extend the processes of Rogers to capture specific aspects of Living Labs. With this paper, we contribute to the existing research on Living Labs by providing a thorough understanding of the processes through which Living Labs develop as platforms for innovation development through business/government collaboration. The findings can also be of use for practitioners in setting-up and managing Living Labs.

Keywords: eCustoms, cross-border trade, innovation, Living Labs, multi-level analysis

1. Introduction

Globalization continuously enhances international trade and the mobility of goods (Deardorff, 2001); at the same time we see a continuous increase in government rules and regulations related to fraud prevention, security and health, which pose significant administrative burden to international supply chains. In the context of the EU, governments are struggling with the dilemma of how to achieve reduction of the administrative burden in order to preserve the competitiveness of EU as an economic

zone, while at the same time ensure that the required level of control and security are preserved.

Two long-term objectives for eCustoms set by the EU aim to address this paradox between control and a reduction of the administrative overhead within the public and private sector (COM, 2003, DG/TAXUD, 2004). The first objective is to facilitate the implementation of Single Window, where a Single Window is defined as "a system that allows traders to lodge information with a single body to fulfil all import or export-related regulatory requirements" (DG/TAXUD, 2004). The second objective is to initiate the implementation of the Authorised Economic Operators (AEO) concept; AEO is a certification system for businesses that can demonstrate high level of compliance towards government regulations. The companies that are AEO-certified will be allowed to perform cross border trade under simplified customs procedures. Information Technology (IT) is seen as a key enabler for achieving these objectives.

The current eCustoms developments in the EU follow a top-down approach, where the government is imposing eCustoms systems to businesses. Especially when it comes to EU-wide customs systems (e.g. the New Computerized Customs System and the Export Control Systems that were recently introduced), the EU is setting the agenda. The systems requirements are developed at the EU level and are subsequently implemented by the governments in the 27 Member States and the businesses. While businesses may have a consultative role, they do not have a decision-making power in these eCustoms developments. As a result of such projects, separate paper-based procedures are replaced with electronic systems. Although such approach may lead to some simplifications, there are doubts from both businesses and government whether it can lead to significant reduction of administrative burden and trade simplification.

In search for new ways for bringing improvement in cross-border trade, the ITAIDE project[1] was set up. It aims to illustrate how, by using innovative technologies and by redesigning current customs procedures, the administrative burden for cross–border trade can be significantly reduced, while preserving the control and security requirements. In ITAIDE, Living Labs are used as research and development environments to provide proof–of–concept for innovative eCustoms solutions (Tan et al., 2006). The set-up of the Living Labs[2] is that businesses, government, technology providers and universities work as equal partners in the process of developing bottom-up innovative eCustoms procedures. In that respect the setting of the ITAIDE Living Labs is quite different than the traditional eCustoms development projects in the EU, as in the Living Labs the businesses and government act as equal in the innovation-development process and the goal is to arrive at win-win redesign. Through such setting, potentially more radical reductions of administrative burdens can be achieved, as the business concerns will also be taken into account during the redesign. As a set-up for development of innovation through business/government collaborations, such Living Labs have recently attracted a

[1] ITAIDE (Information Technology for Adoption and Intelligent Design for E–Government), www.itaide.org, is one of the largest 6th framework EU–funded projects in the area of eGovernment.

[2] Although the term "Living Lab" is sometimes used in other context, the Living Labs to which we refer in this paper have the following characteristics: 1) they involve collaboration between business, government, technology providers and universities, who act as equal partners; 2) they aim to provide innovation with respect to cross-border trade procedures;

lot of attention and have provided rich grounds for research (e.g. Kartseva et al, 2006; Liu et al., 2006; Baida et al., 2008; Baida et al., 2007; Liu et al., 2007; Razmerita & Bjorn-Anderson, 2007; Frößler et al.2007; Rukanova et al., 2007).

The goal of this paper is to create an understanding of the whole innovation processes that take place in the context of Living Labs. To do so, we make use of the innovation-development processes of Rogers (1995) and we apply it to analyze the environment of Living Labs. In our analysis, we take one specific example of a Living Lab, i.e. the Beer Living Lab.

With this paper, we contribute to the existing research on Living Labs by providing a thorough understanding of the processes through which Living Labs develop as platforms for innovation development through business/government collaboration. The findings can also be of use for practitioners in setting-up and managing Living Labs.

The remaining part of this paper is structured as follows. In Section two we discuss the innovation-development processes of Rogers (1995), which serve as conceptual basis for our analysis. In Section three, we present our research methodology. The case analysis is presented in Section four. We end the paper with conclusions.

2. Theoretical framework

Prior research on Living Labs teaches us that a Living Lab is an inter-organisational network in the context of a public private collaboration. The Living Labs contain various factors, reaching from the different stakeholders involved (companies, administrations and academia) which all have own interests and motives to participate in the network. In the Living Labs, legislation and technology play ambiguous role, both can be considered as an enabler or barrier for the collaboration.

Two studies (Frößler et al., 2007 and Rukanova et al., 2007) on Living Labs are particularly relevant from the point of view of innovation development and adoption. The study of Frößler et al. (2007) focuses on the Research and Development phase. Frößler et al. (2007) study focuses primary on this sub-process within the whole innovation cycle and zooms in on the roles different actors can play during this sub-process. Research by Rukanova et al. (2007) focuses on the adoption issues in Living Labs. By defining various levels of the Living lab environment (1. the Living Lab, 2. participating organizations and 3. the wider network) it is possible to address horizontal and vertical interactions between the stakeholders. These earlier studies elaborate only on a sub-process of the R&D or only adoption, Rogers provides a complete innovation development process.

In order to understand the diffusion of a innovation within a environment were public administrations collaborates with private businesses in order to search for new redesign options, it is important to understand the various phases in the innovation-development process. The theory of Diffusion of Innovation is a widely accepted theory for adopting innovations (Carter and Belanger, 2005). Rogers (1995) describes diffusion as:"… the process by which an *innovation* is *communicated* through *certain* channels over *time* among members of *a social system*". Rogers (1995) describes four main elements in the Diffusion of Innovation. These are the innovation it self, communication, time and the social system. The scope of this paper focuses on the time element.

Most diffusion research only applies on the actual diffusion, the S-curve, of the innovation (T=1 T=2). The innovation-development process enables to understand the relevant activities and phases that are made throughout the innovation lifecycle

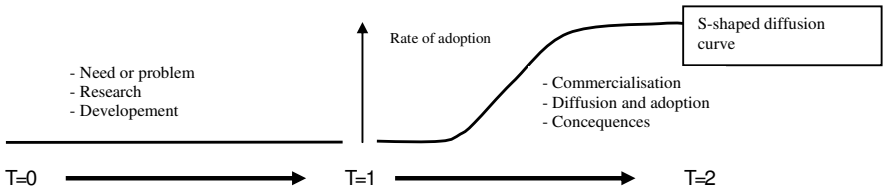

Figure 1: Innovation-development process (adapted from Rogers, 1995)

(T=0 T=2). The innovation-development process consists of six phases. Rogers (1995) starts with a 1) problem or need which will lead to 2) research and 3) development. The development phase is followed by the 4) commercialisation and the 5) diffusion and adoption phase. The innovation-development process ends with the 6) consequences of the innovation. Rogers (1995) argues that these stages are somewhat arbitrary and they do not always occur in this order. The innovation-development process creates an understanding on why an innovation is created and how it is being adopted.

The innovation-development process begins with the recognition of a *problem or a need*. This problem or need stimulates innovators to design a solution for this problem. In some cases innovators can see a future problem and start working on a solution. In other cases a problem or need arises when a change in political legalisation occurs. The *research* for a solution to the problem or need can be split into basic research and applied research. Research and Development are often interconnected. The *development* of an innovation is the process of designing a new idea in a form that is usable for all stakeholders. Uncertainty, skunkworks, social construction of technology and transfer of technology are the four elements that influence the development phase. Rogers (1995) describes the *commercialisation* phase as the phase where the innovation must be manufactured and distributed. The innovation is conversed from research into an actual product that embodies the innovation. Rogers describes the *diffusion of the innovation* as a crucial step in the innovation-development process. The last phase in the innovation-development process is the *consequences* of the innovation. Rogers divides the consequences into three categories: desirable and undesirable consequences, direct and indirect consequences and anticipated and unanticipated consequences. Rogers (1995) addresses that the phases are somewhat arbitrary and they do not always occur in this order. A more detailed elaboration of the phases takes place within the case description.

3. Methodology

Living Labs form a innovation-development environment and the ultimate goal is to bring innovation and change in eCustoms. Understanding the whole process from why innovation is created to how it is being adopted will add very valuable knowledge to the existing research on Living Labs. Thus in this study we will aim to understand to what extent the general innovation-development process developed by Rogers can be applied to the Living Lab setting and what changes would be required in order to reflect the specific Living Lab setting. In order to create an understanding on how innovations, based on a business- government collaboration, are developed and adopted we have the Beer Living Lab as a case study. Within the BeerLL there is a controlled environment where authorities, organizations and technology enablers come together to design an

innovative solution for complex inter-organizational business processes. The BeerLL is a good example for innovative government 2 business activities (G2B) and forms a basis for illustrating how the theoretical framework can be applied in practice. During the analysis of the BeerLL, the case study applies the interpretative tradition (Walsham, 1993) and we follow the process approach (Markus and Robey, 1988). The data collection was performed in the period February 2006- November 2007. For the analyses of the case we acquired several data sources. These data sources include meeting and brainstorming sessions, individual interviews with the actors involved in the BeerLL and an extensive document study. In total, 24 meetings were attended and 32 interviews with experts were conducted. The interviews were conducted in an exploratory fashion, they were semi-structured. A large part of the meetings and the interviews were recorded and in addition meeting notes and minutes of the meetings were prepared. Due to the large number of meetings and recorded material, some of the interviews were only partially transcribed. In the Living Lab we obtained a rich pool of data and we used complementary lenses to try to understand and explain the developments observed in the Beer Living Lab. Rogers was one such lens that we apply. The combined detailed materials were used as a basis for the analysis. In the next section we use the innovation-development process to analyse the BeerLL.

4. Case analysis

The Beer Living Lab is one of four Living Labs of the ITAIDE project. The BeerLL focuses on the administration process of export of excise goods. Its goal is to propose innovative solutions for eGovernment in the context of cross-border trade. The composition of the team involved in the BeerLL consists of a large beer producer (BeerCo), the Dutch Tax and Customs organization, technology providers and a university. The attitude in the BeerLL is to cooperate and look for win-win solutions. The focus in the BeerLL is to analyze how ICT solutions can support the administration of export of excise goods.

4.1.1 Need or problem

The need or problem stage that Rogers defines encourages us to identify the reasons, why a Living Lab is set-up. Rogers describes the need or problem as the input that stimulates innovators to design a solution for this problem. In the Beer Living Lab, we identify three main issues which motivate the need to initiate a Living Lab.

- Fragmented approach in the EU for reporting to the authorities; for the same commercial transactions, businesses need to provide separate declarations to the different authorities (e.g. tax, excise, statistics)
- General solutions are created at the EU level, which are applicable for *all* business organizations involved. This uniform approach has consequences for possible reduction of administrative burdens that can be achieved.
- While business organizations experience a heavy administrative burden from regulations that the government introduces, business have only a consultative but no decision-making role.

These are the key issues that triggered the initiation of the ITAIDE project.

4.1.2 Research and development

The BeerLL was set-up to address the problems discussed in section 4.1.1. While Rogers treats research and development as separate stages in the innovation-development process, our analysis of the BeerLL indicates that these stages are very much intertwined. In the BeerLL the innovation was still being shaped (applied research) during the development phase, were the stakeholders of the project were actively seeking for mutual requirements of the innovation. In order to stress the highly intertwined nature of research and development in the Living Lab setting, we have chosen to merge the research and development phase into a single phase.

What is important to notice is that in the Living Lab, we have several organizations involved (BeerCo, DutchTCA, Technology provider, university). During the research and development phase, only representatives from the involved organizations were involved in the BeerLL. These individuals formed a separate social system with a different set of values and norms (Rukanova et al., 2007).

Rogers observes four elements that influence the research and development phase. Forming skunkworks, the need for dual technology transfer, the reduction of uncertainty and the social construction of technology all relate on the development environment. When we mirror the BeerLL to the first element of the R&D phase, forming *skunkworks*, we see lots of resemblance. The BeerLL network is a group of representatives from the involved organizations who create an innovative solution. The BLL environment can be seen as a platform for knowledge sharing between the stakeholders. The BLL forms an inter-organizational network which can operate outside the legal constraints of EU legislation. The second element of development phase is the *technology transfer*. In the need or problem phase we observed a conventional one way conception of transferring technology and enforcing it by legislation. In the Beer Living Lab transfer of technology is evolved in a dual communication process as is described by Rogers and other scholars. Within the BeerLL we saw that the involved actors participated in a series of communication exchanges throughout the research and development phase as they seek to establish a mutual understanding about the possibilities of the innovation. Mutual understanding about the possibilities of the innovation caused resulted in *reduction of uncertainty* among the members of the BeerLL. We argue that the BeerLL can be seen a separate *social system* with different norms and values and can act without legal constrains. This allows the actors of the BeerLL to develop highly innovative solutions that were not possible in the current social system outside the BeerLL.

4.1.3 Gaining commitment

This phase is not described in the innovation-development process but from our analysis of the Beer Living Lab we find adding such an extra step is essential. This is the stage where the individual members, participating in the BeerLL have to convince their own organizations why and how the innovation developed will bring value. In perspective to Rukanova et al. (2007) levelling framework we can see this as the vertical relation between the gatekeeper involved in the Living Lab and his own organization. Many studies provide insight in technology adoption throughout a organization (Grover 1993; Iacovou C. L., I. Benbasat 1995; Premkumar G. and K. Ramamurthy 1995; Frambach, R.T. and N. Schillewaert 2002). In this paper we elaborate only on the adoption within the B2G environment and especially on the Living Labs setting. In the gaining commitment phase we argue the need of committing the involved organizations to

continue to contribute after the R&D phase. In the BeerLL we identified three factors that play a role in a Living Labs setting.

- The innovation is not just a technological innovation but requires a change in legislation at national or EU level.
- The results from the Living Lab need to be translated into strong business cases in order to gain the commitment of both the authorities, as well as the involved businesses.
- There is a crucial role for the gatekeeper in order to create a profound basis for organizational commitment;

The innovation is not just a technological innovation but requires a change in legislation. Without changing legislation the innovation-development process is likely to stagnate. In the BeerLL we see that the representatives of DutchTCA participating in the BeerLL are very active in their attempts to inform and influence decision-makers at both national and EU level. The ultimate goal is to adjust the legislation in order make further adoption of the innovative ideas possible. The constraining power of the legislation raises the threshold to adopt the innovation. But not only for the DutchTCA it is important to create a strong business case, both the technology provider as well as the business need to have sufficient business drivers to continue to invest in the innovation.

In the BeerLL we see crucial role for the individuals who participated in the Living Lab. The members of the Living Lab can be seen as gatekeepers (Rogers, 1995). There is a crucial role for the gatekeeper in order to create a profound basis for organizational commitment. The role of the gatekeeper can be translated into the role of change agents for the organization. Rogers (1995) describes the essential role for the change agent in the early phases of adoption. It is important that opinion leaders can be influenced by the change agent in an early stage of the implementation process. The duration of the implementation process is depending on the amount of persuasive power between opinion leaders and the other members of the business organization. The gatekeeper also fulfils the role of internal champion (Premkumar and Ramamurthy, 1995) within the organization. The role of the gatekeeper is to educate the top managers and assist potential users of the innovation within their own organization. Because the innovation is designed from a bottom-up approach it is of great importance for the change agent to persuade the top managers of the business organization. (Premkumar and Ramamurthy, 1995; Premkumar, Ramamurthy and Crum, 1997). A lack of persuasive power between the change agent and the opinion leaders will slow down the adoption rate or even stagnate the adoption process in an early stage.

4.1.4 Commercialization

Roger (1995) describes the commercialization phase as the phase where the innovation is shaped and packaged in a form in which the innovation is ready to be adopted by the users. It is clear that during this stage, the technology providers should be ready to be able to supply the technology to the users. However, in the BeerLL we see that not only the commercial parties have to be ready; the authorities should also be ready, by having the proper legislation and procedures in place to work with the new solution. In that respect, while Rogers' perspective on this phase does not include the role of the authorities explicitly, we find this a very important actor in the BeerLL. The constraining power of the legislation, as well as the need to have new legal procedures in place, have to be taken into account. Otherwise, the BeerLL innovation will ultimately not be

adopted, even if the benefits from a business point of view are clear. The importance of the legislative and procedural aspect for the commercialization phase makes the Living Labs different than many other innovation developments processes which are driven purely from commercial concerns. Thus, this aspect needs to be added as a specific concern to the commercialization stage of the innovation-development process of a Living Lab.

4.1.5 Diffusion and Adoption

Rogers (1995) diffusion and adoption phase is described as the actual adoption of the innovation throughout a social system along the S-shaped adoption curve. In the case analyses we speak of the adoption and diffusion in the wider network context (this wider network context relates to what Rukanova et al. (2007) refer to as as level 3, when they analyse Living Labs). In the diffusion and adoption phase we can foresee two scenarios. In the first one, when the legal basis for the adoption of innovation is made available, but it is up to the businesses whether they want to adopt the innovation. The second scenario is if the solution is enforced by law. The first case is similar to the purely commercial setting as described by Rogers (1995). Diffusion and adoption of the innovation in the wider network context , would be dependent on the perceived characteristics of the innovation (Rogers, 1995; Davis, 1989). Diffusion of the innovation without legal enforcement should result in an adoption rate as predicated by the S-curve. Strong business cases for the business parties should trigger potential adopters to adopt the innovation. A risk is that the innovation designed in the Living Lab is more compatible with the business parties involved in the Living Lab than other organizations in the wider network context. However when the EU enforces the use of new technology the adoption S-curve is much steeper.

4.1.5 Consequences

The last phase in the innovation-development process is the consequences of innovations that allow modern trade. In order to forecast the possible consequences for the innovation we use the same three dimensions Rogers (1995) uses to analyse consequences of innovations (i.e. desirable/ undesirable, direct/indirect; anticipated/unanticipated consequences). These dimensions can be used for eliciting the consequences that Living Lab innovations can lead to.

If the innovation is adopted throughout the social system the relation between the government and business is changed in a fundamental way. A desirable consequence might be that there will be a different treatment of trusted companies in appose to companies who do not have institutional trust relation with the DutchTCA. This different treatment of trusted organizations might result in a reduced administrative burden. A undesirable consequence could be that companies, trusted or non trusted, might be forced to introduce expensive new technologies.

The role of the technology provider becomes more prominent in the communication between the public and private sector. A direct consequence might be the improved efficiency of communication between the public and the private sector. Expanding the role of the technology provider helps to streamline the interaction between the government and businesses. Due to the increasing prominent role the technology provider becomes a very powerful player in the spectrum of stakeholders. The adoption of new technology enables more transparency in international trade. Transparency will lead to

better collaborations between Member States and between Europe and the rest of the world. Overall the implementation of new technologies might lead to a more secure world. On the other hand because of the new processes and procedures on international trade, new and more innovative ways of fraud could arise which result in an increase of fraud.

4.2 Discussion

The figure below is an attempt to link the findings from the analysis with earlier research on Living Labs, mainly the levelling proposed by Rukanova et al. (2007). The three levels proposed by Rukanova et al. (2007) to analyze Living Labs, as discussed earlier, are as follows: 1) The level of the BeerLL, where only specific actors from different organizations are involved; 2) The level of the different organizations, which participate in the BeerLL; 3) The wider network, to which the organizations participating in the BeerLL have access.

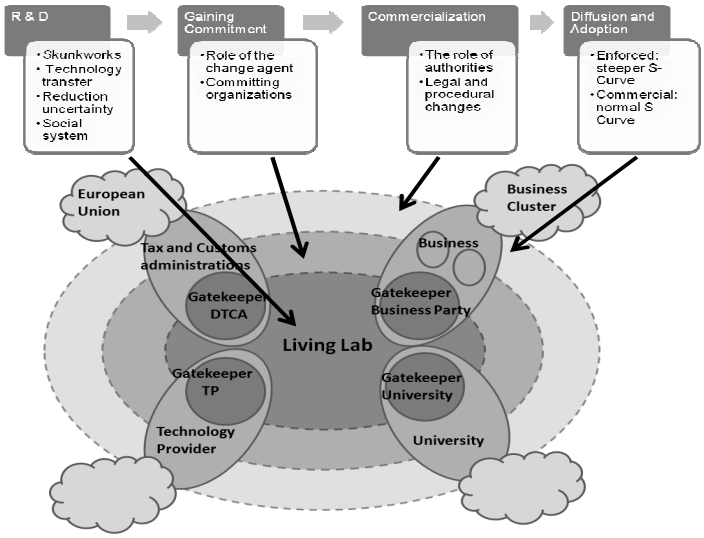

Figure 2: Linking the innovation development phases to the levels of analyses

The input for the process is started with the need or problem. This input triggers the initiation of an innovation development project. A Living Lab starts during the phase of research and development. Because within a Living Lab the phase of research and development are closely intertwined we regard them as a single phase in the innovation-development process. The project is designed in such a way that the actors within the project can work in an enriched environment and can work around the usual organizational process flows. After the R&D phase we added a new phase in the innovation-development process, the gaining commitment phase. This phase is essential because it enables the understanding on how the participants in the Living Lab must mobilize their organizations to invoke further action. We used the same constructs that Rogers used in the commercialization and diffusion and adoption phase, however we added the role of the authorities in the commercialization phase because they are responsible for creating legal prerequisites and fulfil a crucial role in G2B collaborations.

Furthermore, in the diffusion and adoption stage we foresee that the reasons for adoption can be driven from either commercial reasons or enforced by law. The final step, the output of the innovation will be analysed according to Rogers (1995) outcomes in three categories: desirable and undesirable consequences, direct and indirect consequences and anticipated and unanticipated consequences. The last three phases (early adopters, commercialisation & diffusion and consequences) can occur in the future and therefore are analysed on hypothetical basis.

5 Conclusion

In order to create a holistic understanding of the adoption process in a Living Lab context we have applied the innovation-development process of Rogers to the Beer Living Lab. The innovation-development process can be applicable to understand why Living Labs are created and how to place them in the whole innovation-development process. Based on our analysis, we provided extension to the processes of Rogers in order to capture the specifics aspects of the Living Labs. Furthermore, this paper makes a contribution to the existing literature on Living Lab innovations because it combines the levelling structure with the dynamic process approach used by Rogers. This paper allows scholars to pin-point micro level analyses between actors in a certain time frame. In this way, with this paper, we contribute to the existing research on Living Labs by providing a thorough understanding of the processes through which Living Labs develop as platforms for innovation development through business/government collaboration. The findings can also be of use for practitioners in setting-up and managing Living Labs. The innovation-development process can be used as a reference in order to project possible future scenarios´ and how to position the Living Lab in future perspectives.

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