A Living Lab Framework: facilitating the adoption of innovations in international information infrastructures

Inge Lucassen[a*], Bram Klievink[b], Lori Tavasszy[a,b]

[a]*TNO, Delft, the Netherlands*
[b]*Delft University of Technology, Delft, the Netherlands*

Abstract

One of the key challenges that international supply chains face today is the need for improving the quality of the data that is used for business operations and compliance. In many supply chains, individual parties in the chain work with low quality data, even though somewhere in the chain, better data is available. The systems of supply chain partners can be interconnected, creating information infrastructures. However, just interconnecting systems is insufficient. The actors involved need to provide detailed requirements and specifications, including on the sources, processes, and control mechanisms. Living Labs can be used as a collaborative innovation approach that is able to structure the cooperation and content discussions. In this paper, based on analysis of multiple projects, a framework for the use of Living Labs in information infrastructure innovation is presented. The framework positions the stakeholders and their power relations and helps to specify individual and common goals. It guides the participants in developing a collaborative approach to making the innovation work, socially and technically, and on short and longer term.

Keywords: Living Labs; innovation; information infrastructures; international trade; supply chains

Résumé

L'un des principaux défis que les chaînes d'approvisionnement internationales font face aujourd'hui est la nécessité d'améliorer la qualité des données qui sont utilisées pour les opérations commerciales et la conformité. Dans de nombreuses chaînes d'approvisionnement, les partis individuels dans le travail à la chaîne avec des données de faible qualité, même si quelque part dans la chaîne, de meilleures données sont disponibles. Les systèmes de partenaires de la chaîne d'approvisionnement peuvent être reliés entre eux, la création d'infrastructures d'information. Cependant, seulement des systèmes d'interconnexion est insuffisante. Les acteurs concernés doivent fournir des exigences et des spécifications détaillées, y compris sur les sources, les processus et les mécanismes de contrôle. Living Labs peuvent être utilisés comme une approche collaborative de l'innovation qui est capable de structurer la coopération et les discussions de contenu. Dans cet article, basé sur l'analyse de plusieurs projets, un cadre pour l'utilisation des Living Labs en matière d'information innovation de l'infrastructure est présentée. Le cadre positionne les acteurs et leurs relations de pouvoir et contribue à préciser les objectifs individuels et communs. Il guide les participants dans l'élaboration d'une approche collaborative pour faire le travail d'innovation, socialement et techniquement, et à court et à long terme.

Mots-clé: Living Labs, innovation, infrastructures d'information, commerce international, la chaîne logistique

* Corresponding author information here. Tel.: +31-88-866-3617; fax: -.
E-mail address: inge.lucassen@tno.nl

Introduction

Innovations in Information and Communication Technology (ICT) make it possible to improve the information exchange worldwide, by creating electronic connections between organisations (Tan, Bjørn-Andersen, Klein, & Rukanova, 2011). In the domain of international trade, this innovation is key to making today's international trade more efficient and secure. Developments like outsourcing, consolidation, and fragmented transport chains have complicated the organisation and optimisation of logistics. Furthermore, managing information and data in these logistics chains has become a huge challenge. The systems of supply chain partners can be interconnected in inter-organisational systems and jointly form international information infrastructures. Through information infrastructures, data can be shared among supply chain partners and with government. This can greatly enhance the visibility and control of the supply chain.

However, these information infrastructures can only be realised when the diverse stakeholder communities work together. Gathering, sharing and combining information from various sources requires the development of information infrastructures that are used by a wide variety of stakeholders having diverse interests (Klievink et al., 2012). The technical complexities of implementing these infrastructures is complicated by the number and variety of the stakeholders that are affected by and involved in the innovation and decision making processes. For an international information infrastructure to work in the dynamic context of international trade and logistics, the system needs to be flexible, heterogeneous, interoperable, and above all entirely secure. This introduces new complexity and new uncertainties for the parties involved, due to increased interdependence and potential vulnerability (Hart & Saunders, 1997; Kumar & Van Dissel, 1996). A perceived increase in vulnerability due to this kind of innovation may hinder industry uptake. The actors involved in setting it up need to provide detailed requirements and specifications for such a system, meaning that knowledge is needed on the source of the data, the processes in organisations that produce the data, existing control mechanisms, the various systems itself, and how the data can be re-used in processes where quality is important, e.g. in compliance (Klievink & Lucassen, 2013). Actors in the whole chain have to be open about their processes and systems to parties geographically and culturally on the other side of the world. Parties might perceive to be vulnerable when opening up, especially since they are operating in a highly competitive environment. Living Labs offer the possibility to create a safe environment in which parties can create sufficient mutual understanding and trust to perform the crucial first steps in specifying the requirements for a system. For this, collaboration between the many different stakeholders is required. They will have to make a strategic decision on the willingness and necessary investments for sharing information about their processes, products, etc.

In our earlier paper, we demonstrated how Living Labs are able to support the adoption of innovative information infrastructures (Klievink & Lucassen, 2013). Aspects that can influence innovative developments in this area are external pressure, readiness, trust and existing relationships between actors. The more an infrastructure is used in depth – ranging from sharing of electronic documents to sharing work environments- the greater the vulnerability of parties is and hence the higher the need for mutual trust. An absence of trust can be a major barrier for making the innovation work. We concluded that the small-user-group innovation in Living Labs are not just a good instrument to get this done in a research setting, but also to support the eventual adoption of the information infrastructures and support for the required transformation.

In our research, we found that Living Labs as a collaborative innovation approach are able to support information infrastructure development, refinement and adoption by focusing not just on the benefits that parties can gain from the innovation, but also respecting and also dealing with the (perceived) vulnerability such innovations may bring. We also found that there is limited information available on lessons learned for Living Labs and that inexperience of practitioners can result in lower quality results. In the example presented in our previous paper, the Living Labs setting enabled the business community in the trade lane to identify better sources of data to fulfil the requirements for their IOS. This is partly a result from the collaborative approach. At the same time, being able to connect this data source to the inter-organisational data sharing system was also a result from the trust-basis created in the Living Lab setting. The information owner got in-depth information on the way the information would be used by others, and what the supply-chain-wide benefits could be. For them, this mitigated the perceived risk that the information would be used opportunistically. They saw how it could instead strengthen their existing relationship with their European partner and could result in clear benefits for their joint customer, thus strengthening both their positions. Sharing the information through the system enabled

them to improve the information exchange and the efficiency of the supply chain as a whole, instead of optimising the individual steps that any single party could control.

In this paper, based on analysis of and experience with Living Labs and other pilot studies in multiple research and development projects, we propose a framework for the use of Living Labs in information infrastructure innovations. This framework should be able to structure the critical activities for success of Living Labs and help practitioners in a wide context to successfully use Living Labs. The Living Lab framework should address the Lab environment with its stakeholders and their power relations and help to specify individual and common goals. It should help guide the participants in developing team spirit, having structured and at the same time spirited discussions without losing the final common goal. It helps to specify the requirements for the innovation, both on functional and technical level, and on both a short and longer term. By doing this, it also needs to combine the knowledge of existing approaches and research in other areas of study in a framework that is both innovative and practical.

1. Background

Living Labs, shorter for Living Laboratories, have gained popularity since 2005. In 2006, the European Network of Living Labs (ENoLL) came into existence. Already in 2008, the eJOV magazine published a special issue dedicated to Living Labs. The number of publications around the use of Living Labs in innovations has been large throughout the years although most publications focus more on the application and results of a Living Lab instead of focusing on common definitions and an approach.

Looking at the broad application of Living Labs in the research arena, Living Labs seem to articulate user involvement in so-called innovation arenas, from support to entrepreneurial lead users to needs-finding or user experience services (Almirall & Wareham, 2008). Characteristics seem to be a multi-actor involvement, an open, real life environment and public-private partnerships. However, it was argued that with the "type of methodologies used in the Living Labs, it would be unlikely that user ideas and experiences will be captured and understood fast enough to effectively inform product design, limiting in that way the applicability of Living Labs to the type of research that can be effectively addressed with small groups, lead users or needs a superficial level of understanding of the user experience. Parallel to that, the capacity of Living Labs to affect demand lies in creating awareness through real life experimentation. Therefore, this effect too is limited by the size of the sample group." In addition to this, Almirall and Wareham argue that in case a Living Lab is focused on less complex and cheaper solutions compared to existing solutions, without clear bottlenecks for implementation, Living Labs are of no use. Their research provides us with three areas where a Living Lab approach was deemed successful:

- Customization, localization or validation of existing products or services with a group of real users in real environments, resulting in incremental improvements or radical new features;
- Problems with large solution spaces where the involvement of users is relevant and where the selected solution must be embedded into the social fabric in order to be adopted. Example: mobile applications.
- Implementation of interdisciplinary projects with multiple alternatives and business models.

Følstad (2008) researched the literature delivered on Living Lab applications in the context of ICT innovation and development. Nine characterizing purposes were identified, related to three high-level issues, as summarized in below table. Four of the purposes were described as being common purposes, meaning they were encountered in more than 67% of the reviewed materials.

High level issue	Identified characterizing purposes	Common purpose?
Living Lab contributions to the innovation and development process	1. Context research (investigate context of use)	No
	2. Discovery (of unexpected ICT uses and opportunities)	Yes
	3. Co-creation (with users)	No
	4. Evaluation	Yes
	5. Technical testing (in a (semi)realistic context of use)	No
The Living Lab context	6. Familiar context	Yes
	7. Real-world context	No

Characteristics of Living Lab studies	8. Medium or long term	Yes
	9. Large scale	No

From Følstad (2008): "Table 1: Characterizing purposes of Living Labs, grouped according to high-level issues"

Especially the purposes of Discovery and Evaluation seemed relevant in ICT Living Labs, causing Følstad to state "that innovation is not achieved through short and fragmented project initiatives but through long-term innovation efforts involving cycles of gaining new insight and gathering experience of implemented solutions." A first definition of a Living Lab was suggested as being "*environments for innovation and development where users are exposed to new ICT solutions in (semi)realistic contexts, as part of medium- or long-term studies.* Apart from the lack of a common definition and understanding of the use of Living Labs, the author also indicates the non-existence of a common methodology: "Of the five methods mentioned in more than two papers, three were the long-standing methods of questionnaires, focus groups, and observation. These methods may be well suited for some Living Lab studies, but does not represent important methodological advances."

We found that, although a clear definition and methodology for the application of Living Labs still seems to be lacking, re-use of other initiatives, models and methods seems obvious. Although a Living Lab is different from e.g. a field operational test in terms of scale and complexity, its methodology could be a first starting point in drafting a common Living Lab methodology and tackling some of the recurring issues. Also, a lot of research has been done on management of projects and change in complex environments, implementation of organizational change, management of conflicts and trust, evaluation, quality control, etc. If all these topics are relevant for the implementation of a successful Living Lab, then perhaps not only the Living Lab environment is typically complex and multi-disciplinary, but so is its management and methodology.

One example of a methodology that seems promising to use as a starting point for drafting a Living Lab methodology is FESTA. The FESTA methodology was developed in the FESTA and FOT-NET projects, funded under the 7th framework program of the European Commission and is tailor-made for the evaluation of in-vehicle driver support systems in field operational tests (FOT). The methodology defines a field operational test as "*a study undertaken in to evaluate function, or functions, under normal operating conditions in environments typically encountered by the participants using quasi-experimental methods".* According to the consortium members of the FESTA and FOT-NET projects, FOTs are an important means when identifying and verifying real-world impacts of new systems and European R&D investments. The FESTA handbook describes guidelines for the process of planning, preparing, executing and analyzing a FOT, together with its administrative, logistic, legal and ethical issues. The handbook is also a first step towards standardization of the approach, beneficial for cross-FOT comparison of results.

2. A Living Lab Framework

2.1. Research approach

Inspired by the guidelines provided by the FESTA approach, we have constructed a Living Labs framework. This framework is based on our findings from the initialization and piloting phases of seven Living Labs that were part of research and/or development projects in international trade. The Living Labs included large-scale demonstrations on trade lanes between Asia, Europe, the USA and Africa, with up to 15 partners in one Living Lab. The Living Labs typically lasted one to two years. In all Living Labs, at least one of the authors was coordinating or closely involved in the Living Lab. Using the FESTA handbook and other literature, we looked for the common elements in the process followed in each of these Living Labs. Iteratively, the authors presented their Living Labs to each other and refined the framework accordingly. Due to the large scale and the collective experience of the authors, the framework draws on lessons of what worked in these Living Labs, as well as on lessons of which approaches slowed or hindered progress in the Living Labs. Finally, the authors conceptually mapped the Living Lab framework to the Living Labs we were involved in. As a result, we consider this framework stable, but aim to further test and refine it in upcoming Living Lab projects in which it will be used from the start.

2.2. What defines a Living Lab

Building further on the definition of Følstad on Living Labs, we suggest the following generic definition for a Living Lab:

Test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different background and interest work together towards a common goal, as part of medium to long-term study.

As a basis for this definition, we can create an overview of the characteristics of a Living Lab and their purposes compared to for example a pilot or field test. The preliminary results are presented in the table below. When looking at test environments in projects, it can be argued that this distinction is perhaps never entirely clear as many environments would not entail all characteristics of a Living Lab, but are of such complexity that it seems natural to define the test environment as a Living Lab.

Pilots or Field tests	**Living Labs**
Characteristics	
Simplified	Complex
Linear or Static (waterfall development)	Dynamic (iterative, cyclical development)
Isolated environment	System in system, real-life environment
Individual values	Shared values
Mainly operational goals	Grand challenges
Single actor as driver and owner	Multi-stakeholder and collaborative governance (incl. public-private partnerships)
Little uncertainty	Deep uncertainty
Short to medium term	Medium to long term
Re-active planning and steering	Adaptive and pro-active planning and steering
Purposes	
Closed research & development	Open innovation and live analytics
Expert design	Co-creation of multi-stakeholders
Closed system evaluation	System in system evaluation
Policy analysis for single department	Policy analysis for multi-department

Further research and discussion will need to give insight in more typical characteristics of a Living Labs and its differences from other test environments like pilots and field operational tests. Besides, additional aspects can be considered as optional, e.g. the use of modelling and gaming as part of a Living Lab. Before implementing concepts and technology in a real world environment, the concept or technology can be tested in a Living Lab model environment, adding an additional iteration to the Living Lab process. However, when the basic principle and methodology is in place, it becomes easier to improve and enlarge in a structured way such that the methodology becomes applicable for many different environments, technologies and concepts.

2.3. Need for a Living Lab methodology

The lack of a Living Lab methodology clearly has not kept researchers from assigning the ‘Living Lab’ title to any form of demonstration or test environment that includes end-users in co-creation or multiple stakeholders in evaluation. The authors of this paper have seen many projects that use Living Labs for any form of evaluation or analysis and probably numerous Living Labs will be developed under the Horizon 2020 EC program. Although the demonstration in these projects are probably not much influenced by whether it is called by its proper name or not, we want to argue that the concept of a Living Lab is however different from a pilot and a field test and by misuse of the name, the concept is quickly losing its value and becoming an empty buzzword.

A Living Lab methodology can support future testing of concepts and technology, by providing researchers and practitioners with the following benefits:

- Consistency of research across Living Labs, enabling comparison across Living Labs and overall improvements due to more structured knowledge building

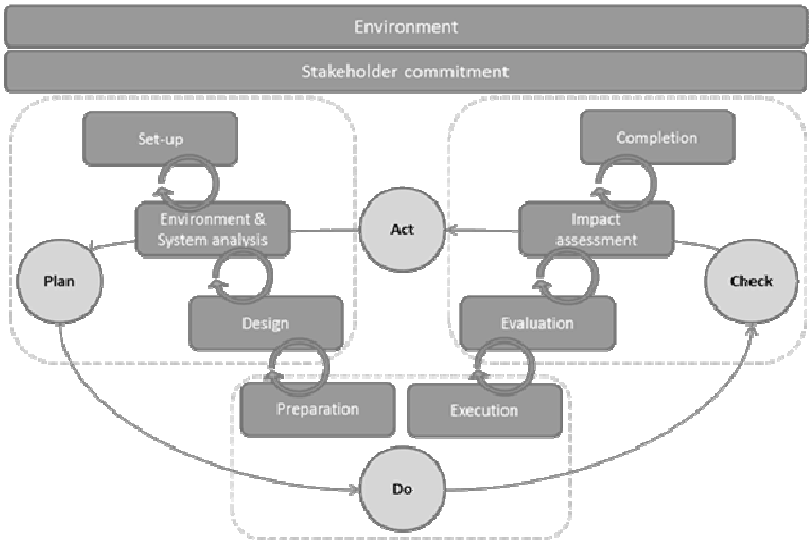
- Consistency in measurements, evaluation results and also expectations for participants
- Overview of the typical activities needed for a successful Living Lab;
- Overview and learning curve of critical issues and lessons learned that influence the success of the Living Lab;

In addition, any framework that is developed for the use of Living Labs will probably also be of use in developing any other test environment as this would in most cases mean a simplification of the methodology. Building knowledge and gathering lessons learned for Living Labs therefor also benefit related methodologies and practitioners in other test environments.

Looking at the scope of a typical Living Lab, the number of participants, the complex changes and technology implementations that are needed, it is easy to conclude that executing a Living Lab is expensive and time-consuming. The FESTA handbook states that earlier FOTs that did not deliver their anticipated outcomes have not done so primarily because of failures to anticipate problems that compromised their successful execution. The same can easily be expected from Living Labs and perhaps even more so because of their increased complexity. Even when not two Living Lab are the same, sharing knowledge and building this in a comprehensive framework can save practitioners probably significant time and therefor also money.

2.4. The Living Lab Framework

Constructing a Living Lab framework, fit to cater for complex test environments, means that simplifications are not only unavoidable but also necessary. The framework intends to provide the practitioners with guidance and is not in any way providing them with a manual. The framework needs to cater for the basic characteristics and purposes and able to include additional or optional aspects in the future. Ideally, the basic building blocks of such a methodology stay in place while the changes needed to fit the methodology to a certain environment, concept or technology are reflected by adaptations in the content of these building blocks.



The first draft of the Living Lab framework is shown here on the right. The framework starts on the top left with the initial Living Lab set-up in the 'Plan' phase. Although the V-shape can suggest a linear approach this is in no way intended to prescribe this. All transitions to next steps can be seen as small iterative processes where new findings and ideas need to be checked with earlier assumptions and plans. This automatically means there a multiple, smaller design loops already during the planning phase of a Living Lab.

The crucial aspect in the *Plan* phase is the building of common knowledge on the environment, the concepts and technologies to be tested, use cases that need to be executed and requirements for implementation (which can be anything ranging from technical solution requirements or administrative process requirements). As we discussed in our previous paper, this phase demands a lot of stakeholder commitment and building trust during this first phase determined to a large part the success of the Living Lab. If the Living Lab coordinator is not able to bring the team to the right level of collaboration and trust, this will seriously endanger the outcomes. Already in this first phase, a Living Lab approach requires a certain set of skills and competences, both analytical and social, for its participants as well as the coordinator. The role of the coordinator in these sessions is to bring the participants together on a social level but also on a content level. The coordinator therefore needs to have basic understanding of the various perspectives and being able to work as a translator and moderator in discussions. We now foresee the following activity blocks in this phase:

- Initial set-up: In this block, the overall goal and ambition for the Living Lab are defined, crucial partners are identified, consulted and involved and the scope of the Living Lab system, as sub-system of the real-world environment is determined. Also, the legal framework, procedures, protocols for communication and deliverables are defined and issues identified. Part of this work will also be done as part of the project plan.
- Environment and system analysis: During the environment analysis block, both the Living Lab system itself and its environment are analysed. Stakeholders, processes, products and technology are analysed in its current state. It positions the stakeholders and their power relations and helps to specify individual and common goals. This will later help the participants in developing team spirit, having structured and at the same time spirited discussions without losing the final common goal. Our earlier project example already illustrated how important this activity is to deliver the right results. During this phase, it is worthwhile to invest in group work session, even if it means flying half of the team to the other side of the world.
- Design: In the design block of the Living Lab, the exact research questions, functionality or concepts to be tested and the use cases are described. During this phase, a review of the initial set-up and environment analysis needs to be done to make sure that all use cases can be performed in the Living Lab system and that no additional stakeholders or partners need to be included. This block also needs to deliver any needed design and system requirements to the next phase.

In the *Do* phase, the focus is on implementing changes in the Living Lab environment, actually perform tests and gather data for evaluation analysis. The necessary changes need to be prepared and implemented and the whole system needs to be prepared to work according to new operating procedures, with new technologies etc. This means that not only the Living Lab environment might need to be prepared but also some of the surrounding systems, as a Living Lab is also a system in a system, where there are boundaries to e.g. other processes where the changes are not implemented. The team should make a thorough investigation to whether the Living Lab is influencing the bigger system and vice versa and how contamination of test results can be prevented. This phase is especially demanding for stakeholder where the concepts and technologies are implemented. In our example Living Lab, these are the businesses that will exchange information via an IOS. We now foresee the following activity blocks in this phase:

- Preparation: In this block, the Living Lab environment is prepared for actual execution. This means that for example IT functionality needs to be developed, staff trained, kick-off planned, etc. Also the mechanism for KPI performance measurement needs to be prepared and the baseline measured. During the preparation phase, also fall back procedures and escalation protocols need to be put in place.
- Execution: During the execution phase, the Living Lab is running. The new concepts and technology are tested in the real-world and input for the evaluation is gathered.

The *Check* phase is the last phase of a single iteration in the Living Lab framework. The quality of the system analysis, use cases and KPIs are now reflected in the results of the Do phase. Depending on the tested concept or technology, a number of KPIs is evaluated and the impact on for example business models, regional or national economy or an industry sector are determined. Here is a crucial point in the Living Lab framework where it needs to be decided whether the Living Lab is completed or another iteration is needed. If a change is deemed successful and the stakeholders would like to make the results available to a wider group, the final completion step is better executed before new innovations are tested in the same Lab environment. This means that all the results are gathered and reported and the innovation is prepared for full-scale roll-out. This means that the end-state of the Living Lab is now also the new state for any new innovation to be tested in this environment. In case the innovation is discarded, the Living Lab environment needs to be brought back to its original state before the environment can be re-used. We now foresee the following activity blocks in this phase:

- Evaluation: The evaluation uses the output of the execution phase to draw up to impact and results of the Living Lab according to the evaluation mechanism of the preparation phase and the KPIs that are included in the use cases.
- Impact assessment: The impact assessment phase takes the evaluation results to a next level by assessing the impact on e.g. business models, the industry and the society.
- Final completion: In the completion phase, the Living Lab is either fully integrated in the logistics system at large, meaning that new technologies and concepts are rolled out further, or the Living Lab is dismantled and there is a roll back procedure in place to bring the Living Lab system back to its original

pre-Lab state. The final completion phase delivers an implementation and exploitation plan for further roll-out in real-life.

The *Act* phase takes the results of the evaluation and impact assessment and uses these to improve the design on start a new iteration in the Living Lab. This might also mean that some activities in the Plan and Do phase will need to be reviewed or rebuild. Although the act phase does not contain any particular activity for now, it is a crucial phase in a Living Lab environment where cyclical development, complex challenges and medium to long term research with small improvement cycles ask for an iterative approach.

The environment and stakeholder commitment blocks include on-going activities that need to be performed to keep the Living Lab up to date with important developments in the environment and to guarantee stakeholder commitment during the whole runtime of the Living Lab.

- Environment: Activities in this block are aimed to keep the Living Lab up to date. For example when legislation changes this could impact the chances of success for the Living Lab or make implementation easier or more difficult. These changes need to be incorporated in the other Living Lab blocks which might need reviewing of earlier work done.
- Stakeholder commitment: This block contains activities to ensure stakeholder commitment by disseminating and validating designs and results in a larger group, but also – very importantly – expectation management with the Living Lab participants. If not managed correctly this can result in unhappy partners which could result in earlier draw-back of partners from the consortium.

3. Conclusions and discussion

As stated earlier, the goal of developing a Living Lab methodology is not just to have a methodology but bring the industry and project practitioners the benefits of consistency in research and evaluation across Living Labs, and structured knowledge building to facilitate a learning curve of critical issues and lessons learned that help make each Living Lab successful. The draft methodology should therefore at least include the topics that were identified in our previous paper on Living Labs for the implementation support of IOS.

We have showed that the current literature on Living Labs is diverse but usually focused on its results and use and not on the underlying definitions and principles. For our Living Lab model, we arrived at the following definition for a Living Lab, where the complexity of a Lab study is clearly visible:

A Living lab is a test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different background and interest work together towards a common goal, as part of medium to long-term study.

In our previous work, we concluded that “the examples from the CASSANDRA Living Labs show that working in dedicated teams can work really well in creating an open and safe environment. The lessons learnt show that a specific, shared and well-understood objective for the cooperation is crucial for selecting the team and also final success. Working jointly on a common understanding of the trade lane and the stakeholder’s needs not only brings knowledge but also improves the relationship and team spirit. The people working in the team need a certain set of competences and skills in order to create this positive atmosphere and work effectively. Also, the role of the neutral coordinator is important to moderate the discussions and to facilitate mutual understanding with necessary functional translations. The common understanding is the crucial starting point for developing a common roadmap to implement an IOS for a group of organizations”. All of these topics can be addressed in more detail in the left side of the model, where the building blocks can include activities to help build the right team, address the project and Living Lab goals and work towards a mutual understanding of trade lane, project ambitions, stakeholders and their interest and the solution’s design requirements.

When a Living Lab includes a public-private partnership or power relations are in scope, this adds another dimension to the standard complexity. It is essential to formulate the constraints and incentives imposed by authorities to keep the discussions focused and within their legal frame. This is important to steer the project’s efforts in a direction which results in not only a technically viable solution but also a solution that fits in current policy, and as such is acceptable and accessible for the market after the project ends. This alignment is started in the Plan phase but then continues in the environment block at the top of the model. At the same time, complexity also arises from the power relations that exist naturally between public authorities and private businesses.

Managing a public-private partnership in Living Lab innovation requires both public and private parties to reach a certain level of understanding and trust, which needs careful balancing of influences, benefits, and especially expectations on both sides. This starts in the Plan phase of the Living Lab and is a continued concern of the coordinator in the stakeholder commitment block at the top of the framework.

However, looking at the examples and experiences, it first becomes clear that the success of a Living Lab is highly dependent on the specific activities that need to be performed, and the high level in which the blocks are now defined is not nearly specific enough to help practitioners, second that the success is also highly dependent on the experience, knowledge and capabilities of the coordinator, and third that a broad area of competences and knowledge are requirements for success. The examples from the CASSANDRA project show clearly that a big part of the Living Lab success comes from the blocks in the left side of the model, but also that much more work is needed to turn the model into a valuable guideline for Living Lab practitioners.

The authors of this article have been involved in various Living Labs or pilot studies in the context of international logistics chains, compliance and information technology and will very likely do so in the future. Their aim is to work out the Living Lab model in more detail during future projects. However, only a limited amount of related knowledge and experience is available with us and therefore we welcome any discussion and input from other experienced practitioners in Living Labs.

Acknowledgements

This paper results from the CASSANDRA project (FP7; SEC-2010.3.2-1, grant agreement no. 261795) and the LogiCon project (FP7; SST-2013-RTD-1), which are supported by funding from the 7th Framework Programme of the European Commission. Ideas and opinions expressed by the authors do not necessarily represent those of all partners of the project.

References

Almirall, E., & Wareham, J. (2008). Living Labs and Open Innovation: Roles and Applicability. *eJOV, 10*(Special Issue on Living Labs).

Følstad, A. (2008). Living Labs For Innovation And Development Of Information And Communication Technology: A Literature Review. *eJOV, 10*(Special Issue on Living Labs)

Hart, P., & Saunders, C. (1997). Power and trust: Critical factors in the adoption and use of electronic data interchange. *Organization Science, 8*(1), 23-42.

Klievink, B., & Lucassen, I. (2013). Facilitating adoption of international information infrastructures: a Living Labs approach. *Lecture Notes in Computer Science, Proceedings of IFIP EGOV 2013, Koblenz, Germany*.

Klievink, B., Van Stijn, E., Hesketh, D., Aldewereld, H., Overbeek, S., Heijmann, F., & Tan, Y.-H. (2012). Enhancing Visibility in International Supply Chains: The Data Pipeline Concept. *International Journal of Electronic Government Research, 8*(4).

Kumar, K., & Van Dissel, H. G. (1996). Sustainable collaboration: managing conflict and cooperation in interorganizational systems. *MIS Quarterly, 20*(3), 279-300.

Tan, Y.-H., Bjørn-Andersen, N., Klein, S., & Rukanova, B. (Eds.). (2011). *Accelerating Global Supply Chains with IT-Innovation. ITAIDE Tools and Methods*. Berlin: Springer.