The potential of experimentation in Business-to-Business Living Labs

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Keywords: *Living labs, business-to-business, experimentation, user research, testing*

Abstract

The demand for business-to-business (b-to-b) Living Lab projects is growing significantly within iMinds Living Labs. Real-life experimentation is a key requirement for Living Labs as it enables deeper insights in the potential success of the innovation. However, literature has not provided insights on whether the Living Lab methodology is an appropriate approach for real-life experimentation with b-to-b innovations and does not provide conditions where experimenting in b-to-b Living Lab projects is applicable. Within this paper we performed a cross-case analysis of eight b-to-b Living Lab cases. We conclude that real-life experimentation is possible in Living Lab projects but the possibilities vary on a case level. Three barriers have been identified that help to determine the possibility of real-life experimentation in a b-to-b Living Lab project: the technological complexity, the need for integration and the difficulty to identify testers. Finally, we also described how these blocking factors can be overcome. This can be interesting for the reader to identify whether real-life experimentation will be possible or not in a b-to-b context.

Introduction

Contemporary organizations offering Living-Labs-as-a-service (Ståhlbröst, 2013) are confronted with an ever-increasing demand of business-to-business oriented projects. iMinds Living Labs offers Living-Labs as-a-Service since 2009 in order to reach its mission to facilitate digital innovation in Flanders. The service offering of the iMinds Living Labs is focused on exposing potential users to SMEs their innovations. iMinds Living Labs works on bilateral projects with SMEs, where one project usually lasts three to six months. Table 1 shows a significant increase of b-to-b projects in the portfolio of the iMinds Living Labs. In the period from 2014 to 2016 more than half of the projects were b-to-b oriented.

Table 1: Evolution of b-to-b Living Lab cases in the iMinds Living Labs from 2012 to 2016

	B-to-b	B-to-c	Total	% B-to-b
2009 to 2014	4	18	22	**18%**
2014 to 2016	21	19	40	**53%**
2009 to 2016	25	37	62	**40%**

However, the proof-tested methods used in b-to-c projects are not always applicable in the more complex and demanding b-to-b environments. In the context of Living Labs, the innovation process evolved from a single-inventor perspective towards a collaborative development of two or more actors. In these collaborative efforts, the crucial role of co-creation has to be emphasized (Bogers, Afuah, & Bastian, 2010; Schuurman, De Marez, & Ballon, 2015), which poses complications in the context of b-to-b projects as will be discussed below. Organizations want to utilize co-creation in order to tap into the knowledge of (end-)users (Kristensson, Matthing, & Johansson, 2008). Følstad (2008) argues that, in order for users to provide valuable contributions to the innovation at hand, they need to be able to experiment with the innovation in this real-life context. Therefore, it is of utmost importance to provide users with ample opportunities to experiment with the innovation, at least in a familiar and preferably real-life context. The application of real-life experimentation in b-to-b oriented Living Lab projects poses methodological as well as practical challenges and implications for organizations offering Living-Lab-as-a-service.

The key focus of this paper is on the application, the challenges and the implications of real-life experimentation in b-to-b oriented Living-Labs-as-a-service projects. In the first part, we will briefly review the relevant literature of b-to-b Living Labs and b-to-b experimentation. In a second part, we will describe eight Living Lab projects with their used methodologies, the level of experimentation and the barriers for experimentation. In a final part, we will discuss our findings and suggest the appropriateness of b-to-b Living Lab projects and provide guidelines for b-to-b experimentations. Last, we will offer avenues for future research.

Real-life experimentation in Living Labs

Schuurman (2015, p. 8) describes "*Living Labs as a tool for distributed innovation that drives co-creation between the different involved actors, and with a central role for users*." He considers the following five main characteristics of Living Labs: active user involvement, real-life experimentation, a multi-method approach and an innovation process based on co-creation facilitated by a multi-stakeholder organization (2015, p. 169). One of the most distinctive characteristic concerns real-life testing or experimenting. In Schuurman's framework (2015) real-life experimentation is situated at the meso-level, bridging user (micro-level) and open innovation (macro-level). Living Labs distinguish themselves by testing in real life environment and by confronting (potential) users with products and/or services in the innovation process (Niitamo, Kulkki, Eriksson, & Hribernik, 2011; Schuurman & Marez, 2012; Coorevits, 2015). Testing enables the innovation to first develop context-specific insights on the development and acceptance of the innovation, second to inform researchers about the conditions of acceptance of the technology and last the impact of the innovation on the society and on its environment (Frissen & van Lieshout, 2004).

Test and experimentation platforms (TEPs), being one of the conceptual predecessors of Living Labs, share the crucial characteristic of real-life testing or experimenting. One of the main notions of TEPs is on the "*confrontation of (potential) users with (prototypes or demonstrators) of technology early on in the innovation process*": providing context-specific insights, and conditions for the stimulation of societal and economic technological embedding and the generation of images of potential societal impacts of innovation (Ballon et al., 2005). Følstad (2008) describes, amongst others, two contexts inherently connected to Living Labs: the familiar context and the real-world context. The familiar context can serve as an alternative to the real-world, by allowing more balance between the threat of low ecological validity related to test-labs and the uncontrollable aspect of field studies. In b-to-b contexts a familiar context might be a pilot-environment or prototype environment wherein the real-life context is simulated as best as possible. Researchers often opt for the familiar context so they can maintain control over a selection of elements they want to investigate e.g. pre-defined task execution to determine the learnability of an application. Next to the familiar context, the real-world context is described. Here, in the context of b-to-c oriented Living Labs, (end-)users are confronted with technology in their everyday lives. In this situation researchers cannot control the users' actions and the external elements influencing their behavior. The real-life aspect of the test environment has to provide the researcher with 'unexpected' outcomes to improve the innovation (Sauer, 2013). To put it in the words of Almirall et al. (p16, 2012): *"Real-life contexts are much more than a more realistic scenario for validating proposals; they form an arena where new meanings can emerge, tacit knowledge can be captured, and the whole ecosystem can be validated."*

The academic importance attained to real-life testing and experimenting supports us in our thoughts to assess the applicability in b-to-b oriented Living-Labs-as-a-service projects. Especially because these projects are more complex we need to research whether real-life testing is possible in these environments and how it can be done.

Lack of insights of real-life experimentation in b-to-b Living Labs

Although some authors (Ballon, 2005; Almirall, 2012) explicitly mention b-to-b Living Labs, no clear insights are provided on the application of real-life experimentation in these distinctive environments. Ballon (2005), for example, makes note of considerable differences to experiment with innovations between b-to-b and b-to-c test and experimentation platforms (TEPs). However, no guidelines were provided on this matter. Further, Almirall et al. (2012) mention most cases in the Catalan Living Labs being b-to-b projects. Also here, the authors refrain from going in-depth on the methodological differences between b-to-c and b-to-b contexts.

The lack of well-grounded methodological as well as practical guidelines for this distinctive b-to-b context, supports this paper's relevance when focusing on a more profound and in-depth assessment of these b-to-b Living-Lab-as-a-service projects. This is supported threefold: first, the interest in b-to-b oriented Living Labs is growing, but the literature has not yet followed this emerging trend as only a few authors made reference to b-to-b Living Labs. Second, the iMinds Living Labs experiences difficulties with the translation of b-to-c methods in a b-to-b context in a practical manner. Finally, the literature shows that real-life experimentation in Living Labs is of a crucial nature, which is expected to be similar in b-to-b Living Labs. Supported by these observations this paper wants to fill the gap in literature by finding an answer to the following two research questions:

- **To what extent is real-life experimentation in b-to-b Living Labs possible?**
- **What are the conditions for real-life experimentation in b-to-b Living Labs?**

Methodology

In order to provide an answer to the above-stated research-questions, we opted to use an exploratory action research approach (Davision, Marinsons & Kock, 2004). We selected eight cases which were executed by iMinds Living Labs as part of their Living-Lab-as-a-service tailored towards SMEs. The authors were actively involved in these projects, and assisted the project-owners to implement the outcomes of the Living Lab projects.

We performed an analytical exercise where different blocking factors for field studies and experimentation were identified. The blocking factors were applied on the eight selected cases by means of a cross-case study. The use of a case study approach is supported due to the absence of a clear supporting theory (on b-2-b Living Labs) and its exploratory nature whereby key variables and their relationship are under investigation (Eisenhardt, 1989; Yin, 2009). Case study research is defined as an empirical inquiry that investigates a contemporary phenomenon in its real-life context, when the boundaries between the phenomenon and context are not self-evident, and when multiple sources of evidence are used (triangulation of data) (Yin, 2009).

To ensure reliability, relevance and comparability, the cases were selected according following criteria: 1) the Living Lab projects had to be completely finished, 2) the cases were carried out between 2012 and 2016 and 3) the cases were of b-2-b nature. The cases were anonymized. An overview of the selected cases is provided in table 2.

Table 2: Overview and description of the 8 utilized cases in the research

CASE	DESCRIPTION
Case 1	A technology aiming to improve case-management of processes in companies
Case 2	A startup on digital signage of content applications
Case 3	Improving the sourcing process by improving the information exchange between requestors, collaborators, buyers
Case 4	Coaching managers and employees on change
Case 5	A solution to build, share and manage knowledge in companies
Case 6	An Internet Of Things (IoT) platform in a b-to-b context enabling companies to prototype IoT solutions
Case 7	A solution to track the location of goods in the circular economy
Case 8	An integration layer between issue-tracking software

Findings

We analyzed the different methods used in the eight selected Living Lab cases in order to identify the most commonly used research methods in a b-to-b setting. Next, the level of user-involvement in a b-to-b setting is assessed throughout the different cases, which led to blocking factors that prevent Living Labs to operate in a b-to-b setting.

Level of user involvement in business-to-business experiments

Living Labs utilize several research methods (see table 3) to involve users, identify needs and experiment with the innovation. Interviews is the most common research methodology and is mainly utilized to identify the needs. The focus group is not as prevalent when compared to b-to-c Living Labs. **Attracting sufficient participants and/or respondents** is generally a challenge to organize in focus groups and surveys. Usually, the blocking factor is to attract sufficient participants, as the pool of potential participants is smaller in a b-to-b setting as very specific profiles are required. The events are therefore used to attract more stakeholders, as more information is shared with the participants.

In the eight cases, two field studies have been performed in the context of the Living Lab project. In one project the results of a field study performed out of the context of the Living Lab had been used (case 1). Two other Living Lab projects resulted in a field study out of scope of the Living Lab case (case 6 and 8). The blocking factors specific to the field study will be subject to the further research in the paper.

At each research step in table 4, a scale between 1 and 4 was utilized in order to measure the extent of user involvement. **Level 1** stands for users who are being asked what their **needs** are in an exploratory manner. **Level 2** is when users are able to **see an innovation**, but do not have the chance to interact with the innovation in order give valuable feedback. Coorevits and Schuurman (2015) argue that innovation is unpredictable because of contextual factors influencing the product usage (Sein, Henfridsson, Rossi, & Lindgren, 2011) and therefor the testing of products built in the front end of design is crucial. Forlizzi and Ford (2000) stress the importance of the context of use which influences the interaction of the user with the innovation. Therefore, Level 3 (testing in a familiar context) and 4 (real-life context) go one step further, as the user can interact with the innovation. Følstad (2008) makes a difference between **familiar (semi-real-life) contexts (level 3)** and **real-life contexts (level 4)**. Allowing users to try out the innovation in a familiar (semi-real) context makes Living Labs a useful supplement to traditional experimentation environments such as usability laboratories field studies. Testing in the real-life context goes one step further as users will interact with the innovation in their real-life setting. We interpreted level 3 as testing where the innovation is tried out, but it is not interacting with the entire ecosystem the product usually would operate and thus not integrated with other processes. When level 4 experimentation occurs, the entire ecosystem is involved and integration is included as well.

In this research, we identified whether users were asked about their needs (level 1), have seen the innovation through a demo or video (level 2), have interacted with the innovation but on a familiar, semi-real context (level 3) or on a real-life context (level 4).

Table 3: Level of user involvement in b-to-b Living Lab research methodologies,

	SURVEY	INTERVIEW	EVENT	FOCUS GROUP	FIELD TRIAL
Case 1		2	2	2	4*
Case 2	2				4*
Case 3		2			4
Case 4		2			3
Case 5	2	2			
Case 6		1			4*
Case 7		1			
Case 8		2		2	4*

Level 1: Needs were asked, Level 2: Visual (demo/video), Level 3: Semi-real-life context, Level 4: Real-life context, if kept empty this research step was not taken

****Field study happened out of the scope of the Living Lab project but were directly linked to the project as the results were used or as a continuation project***

One can observe that in surveys, interviews, B2B workshops and focus groups, the user in a professional context never gets exposed to the innovation in order to experiment. Field studies usually go beyond this step and are able to test the innovation in a semi-real and/or real-life context. In 5 cases, iMinds Living Labs was able to perform a field study in a real-life context (level 4), while in one case the research was performed through a Proxy Technology Assessment (level 3) (Coorevits and Schuurman, 2015). Users can be brought in contact with existing technologies that are configured to mimic the behaviour of the prototype that the project team has in mind. This is done through a Proxy Technology Assessment (PTA) (Pierson et al., 2005).

Blocking factors for testing in Business-to-Business Living Labs

As identified in an analysis the iMinds researchers performed of the b-to-b projects, the different blocking factors can be divided between firm specific and project specific factors as described below The company and project specific blocking factors were validated throughout the eight case studies, to identify which blocking factor was applicable in which case.

A) Company specific blocking factors

The **company specific factors** which can block the innovation are inherent to the innovation, and are usually a given in a Living Lab project are:

- **Addressed Need**: the problem-solution fit of the innovation
- **Product Stage**: A product evolves from the idea/concept phase into a prototype into a product (launch vs. prelaunch).
- **Integration with other processes**: The level of integration of the innovation with processes in a company can be a blocking factor, as a company is not always willing take the risk to adapt processes for an uncertain innovation.
- **Complexity of the technology**: The complexity of the technology of a product can be a blocking factor, as the expertise of user researchers is not always sufficient in the case of highly complex, technical problems.

In table 4 one can observe the different company specific blocking factors for experimentation in a b-to-b Living Lab. Values in bold show a blocking factor and can explain why no field study was performed, or was a factor that explains field study that did not succeed entirely.

In the first column, we made clear whether experimentation happened in the context of the innovation. Additionally, the four blocking factors in a company setting (addressed need, in which product stage the company is, the need for integration and the complexity of the technology) were assessed. If one of them was an actual blocking factor, the factor was put in bold and italic.

Table 4: Company specific blocking factors for experimentation in b-to-b Living Lab

	TESTED	Company specific			
		Addressed need	Product Stage	Integrate with processes required	Complexity Technology
Case 1	4*	***Need not addressed (too early)***	Prototype	No blocking factor	No blocking factor
Case 2	4*	Need addressed	Product Launched	No blocking factor	No blocking factor
Case 3	4	Need addressed	Product Pre-launch	No blocking factor	No blocking factor
Case 4	3	Need addressed	Prototype	Blocking factor but used PTA	No blocking factor
Case 5	NO	Need addressed	Product Launched	No blocking factor	No blocking factor
Case 6	4*	Need addressed	Product Pre-launch	**Blocking factor**	**Blocking factor**
Case 7	NO	***Needs not addressed***	**Idea/Concept**	No blocking factor	No blocking factor
Case 8	4*	Need addressed	Prototype	**Blocking factor**	**Blocking factor**

Field study happened out of the scope of the Living Lab project but were directly linked to the project as the results were used or as a continuation project

One can observe that the in case 1 and 7 no field-trial was performed in the context of the Living Lab, as the need was not addressed which led to difficulties to identify a testing entity. In case 7, the company was still in an early idea phase without any product or prototype, which could be tested, which is a blocking factor for testing. Thus, interviews were held, but the conclusion was that there was no need for the innovation. In cases 6 and 8, the field study was not performed within the context of the Living Lab as integration with processes was required leading to a high barrier for the companies to engage into testing. Combined with a higher technological complexity this led to a potential limited added value of the researcher. An extended IT expertise was required in these cases.

B) Project specific blocking factors

Additionally, project specific factors as discussed in table 5 are generally inherent to the Living Lab project, and can be more flexible:

- **The research question:** A research question can be to explore the market, to investigate how the innovation can be positioned or to validate and develop a product. In the case of an explorative question a field study can be a blocking factor as in some cases the innovation context is less clear and needs to be investigated.
- **The budget:** Living Labs can he highly unpredictable and field study are resource intensive. Due to these reason, it is possible that at the stage of a field study no more budget is free to allocate to perform a field study

- **The ability to identify testers:** Living Labs depend on the ability to identify/recruit potential users who want to test the innovation

Table 5: Project specific blocking factors for experimentation in b-to-b Living Lab

	TESTED	Project specific		
		Research Question	Budget	Identify testing entity
Case 1	4*	Validate product	Not sufficient	**No testers found**
Case 2	4*	Market Exploration	Sufficient	Testers found (Used existing clients)
Case 3	4	Validate product	**Not sufficient (2 more planned)**	**No testers found (Used existing clients)**
Case 4	3	Validate and develop product	Sufficient	Testers found (Identified in Living Lab)
Case 5	NO	**Market Exploration**	Sufficient	Testers found
Case 6	4*	Validate and develop product	**Not sufficient (Out of scope)**	Testers found (Identified in Living Lab)
Case 7	NO	**Market Exploration**	Sufficient	**No testers found**
Case 8	4*	Validate and develop product	Not sufficient (Out of scope)	Testers found (Identified in Living Lab)

In cases 1,3,5,7 and 8 the blocking factor to perform a field study was that no testers were found (within the context of the Living Lab). The core reason for this difficulty is similar to the roadblock to **attract sufficient participants and/or respondents** in focus groups and surveys. The blocking factor to attract sufficient testers is complicated as the pool of potential participants is smaller in a b-to-b setting as very specific profiles are required. Testers are recruited based on sector, type of business, size of business, on a company level and seniority, position, expertise on a personal level and the willingness to cooperate linked to a business need. These different criteria make the pool of selection rather small, and lead to difficulties to attract testers.

In case 3,6 and 8, many resources went into the identifying testers, which proved to be difficult and resource intensive. As more time than expected is spent on identifying testing entities, the budget is an additional constraint.

Discussion: 3 b-to-b specific blocking factors for experimentation

The results indicate that certain company and project specific factors are interconnected barriers to implement a field study, while others are stand-alone blocking factors, which are specific to experimenting in a b-to-b context. The b-to-b specific blocking factors results into a three layered model for B2B experimentation which can be found in Table 6.

Table 6: Three-layered model for B2B experimentation within Living Labs

Identified Problems		(Possible) Solution	
	Process Integration		**Simulate innovation**
	Technological Complexity		**Apply filters and/or integrate technology experts**
	Identification of testers		**Project-owner organizes field test and/or involves existing clients**

Factor 1: Process integration

When setting up a field study, e.g case 4, 6 and 8, integration was required between the innovation and the existing processes in the companies. If integration is required, the company needs to make a larger commitment to adapt existing processes in the firm and the IT department of the company will need to be included in the project leading to higher complexity.

Nevertheless, in case 4 a Proxy Technology Assessment was made, where the technology was simulated through an alternative, simpler solution that could circumvent the difficult integration with existing procedures. A proxy technology assessment allows to take into account the context influencing the interaction of the user with the innovation in the front end of design and thus can provide an alternative to a field study early in the innovation process (Coorevits & Schuurmans, 2015).

In cases where real-life testing proves to be difficult due integration with other processes we argue to **utilize simulations of the innovation**, such as Proxy Technology Assessments.

Factor 2: Technological complexity

In Case 6 and 8, the technology was highly complex, as the target market was IT professionals in organizations. The user researchers do not necessarily have a deep background on an expert level of these innovations, which made it difficult to provide meaningful inputs of a Living Lab.

For that reason, throughout the project the decision was made not to perform a field study nor was it possible to test the concept, as the observation of the impact of the context on the product was not possible for the user researcher, which is a crucial part. The complexity in both cases was linked to the need for integration, thus factor 2 and factor 3 (possibly) go hand in hand, but needs to be subject to further research.

We argue to either exclude too complicated technologies from Living Labs, or to train technical experts to perform experimentation in technologically complicated environments.

Factor 3: Identification of testers

Case 3 and 6 did not perform a field study, or did less field study as expected due to the difficulties to identify B2B testers due to a smaller pool of potential testers. Due to this smaller pool of potential testers, the recruitment of testers is more resource intensive as in b-to-c projects.

We can overcome this factor by **utilizing existing clients** of the instigator, as this might make the process of identifying testing entities more efficient. A Living Lab project can as well be a **starting point for another research** project focusing on the field study in a one-on-one relationship between two research partners, as was the shown in case 6. Alternatively, the Living Lab can coach the instigator to perform the field study to structure the **field study organized by the instigator** itself.

Conclusion

Based on eight b-to-b living lab cases one can conclude that **experimentation in a (semi-) real-life level is possible, but depends from case to case**.

We identified three blocking factors for experimentation on a project level and on a company level.

- The first blocking factor to **integrate with existing processes** indicates it will be important to gain support from the IT department within an organization to allow the field study to take place and to avoid a sales cycle**.** To overcome the integration, prototypes, which do not integrate as heavily with the existing processes, can be utilized to test the innovation.

- Second, the **technological complexity** requires experts in different domains to be part of the Living Lab project and guide it in the right direction. IT profiles can be integrated in the project in order to overcome the technology barrier.
- Third, the **difficulties to recruit testers** can be solved by performing tests on existing clients of the instigator and by performing field study out of the scope of the Living Lab project. Living Lab researchers can coach instigators how to perform tests. Additionally, in order to recruit testers for field study within the context of the Living Lab, existing clients can be used.

Further research could identify whether these 4 guidelines can be applied to all cases. iMinds Living Labs will also need to identify whether the guidelines need to be extended and applied into different cases.

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