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Understanding the underlying factors of living lab business model

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Abstract: Living lab is an open innovation approach highlighting active user involvement, multi-stakeholder collaboration while conducing testing and development activities in real-life settings across the different innovation process stages. Partially sequential mixed method approach was applied to evaluate more in-depth what kind of business models living labs are following as well as identifying the underlying factors influencing the business model selections. The sample group consisted 15 health and wellbeing living lab organizations from eight different countries. Findings indicate that all sample group organizations were about to change their business model strategy in near future, thus indicating that the living lab business models are not yet stabilized. The following four different change strategies were identified: "Fine tuning", "Minor adjustment", "Rescoping" and "Frog leaping". Factors influencing business model selections and change strategies are discussed.

Keywords: living lab, business model, business model canvas, healthcare, wellbeing, strategy, change strategy, future strategy plan

1 Introduction

The European Network of Living Labs (ENoLL) – the international federation of benchmarked Living Labs in Europe and worldwide, – defines living lab as follows: "*User-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. They operate as intermediaries among citizens, research organizations, companied, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses. Living labs have common elements but multiple different implementations.*" The living lab movement has gained interest since mid 2000s, but has been struggled to find sustainable business models to operate (Gualandi, and Romme, 2019). Currently most of the living lab funding is coming either from public grants or from fixed public funding making them highly depending on the political support (Santonen and Julin, 2019). In all, the studies focusing on living lab business models are relatively limited and very little is known especially why living lab are following a specific business model and what drives their business model choices. Furthermore, there is also a lack of studies,

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which are systematically evaluating the living lab research domain as a whole (Santonen, 2018). Therefore, the aim of this study is (1) to evaluate if and how the living lab business models are going to change in the near future and (2) to identify the underlying factors and drivers, which are influencing current and future living lab business models selections. Revealing these factors could help to develop better business model for future or at least explain why successful business model development has been so difficult.

2 Prior research on living lab business models

Rits et al. (2015) summarized the body of knowledge regarding living lab business models and identified three main thematic areas within living lab business model studies: First, there are studies evaluating multi-stakeholder driven collaboration. Second the studies that are discussing how living labs could generate revenues by meeting the market needs. Third group of studies consider living lab as tool or methodological approach to identify business model opportunities for organizations who are using living lab services.

There has been efforts to evaluate living lab business models more structurally by utilizing Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010) or related Value Proposition Canvas (VPC) which however is not without critics (Osterwalder, 2012; Coorevits et al., 2014). Mastelic et al. (2015) aligned ENoLL member evaluation criteria into BMC approach and classified effective members into four innovation intermediary segment: innovation consultants - innovation traders - innovation incubators - innovation mediator. Santonen and Julin (2018a, 2018b, 2019) developed and tested BMC survey instrument which enables empirical comparison of the LL business models. D'Hauwers et al. (2015) proposed Assumption Board tool for living labs, which besides BMC and VPC integrated also Porter's five forces model (1985), business model matrix (Ballon, 2007) and Lean startup principles from Ries (2011) into one board. The Assumption Board is a rare example, which notifies underlying factors influencing the living lab business model. However, originally the five forces model was targeted to understand the competition drivers in private industry, while most living labs are managed by public authority or academia and receiving public funding. Therefore, the five forces model is not covering all the aspects such as policy making or fully recognising the characteristics of operating in an open innovation networks consisting various types of Quadruple Helix actors.

Katzy (2012) proposed living lab business excellence model, which inherits its idea from total quality management literature and give guidance to design and implement a living lab. The model includes three stages named ideation, co-creation and venturing. Also Schaffers et. al. (2007) adopted a stage model and highlighted that living lab business model focus takes different forms depending on which of the following three evolution phases they are operating: (1) initialisation and preparation, (2) operation or (3) upscaling and commercialization. Authors also proposed preconditions and success factors such an importance of partnership design. Other living lab classifications includes e.g. Leminen et. al. (2012) four tier typology grouping living lab as (1) utilizer driven, (2) enabler-driven, (3) provider-driven, and (4) user-driven living labs. As a result, it is argued that the body of knowledge regarding living lab business models is somewhat scattered and the underlying factors and drivers influencing living lab business model decisions are blurry.

3 Research design

The unit of analysis in this study is a health and wellbeing living lab hosting organization. The sample group organizations were taking a part to the ProVaHealth-project funded by the Interreg Baltic Sea Region European Regional Development fund. Country wise the dataset included 15 living lab organizations from Estonia, Denmark, Finland, Latvia, Lithuania, Poland, Germany and Sweden. On the average, the participating living labs had operated ca. 6 years (ranging from 1 to 13 years). The data collection followed partially sequential mixed method approach (Leech and Onwuegbuzie, 2009) as follows.

First, the participating living labs and their hosting organizations websites were analysed to find basic information about their generic profile and activities and each living lab conducted a self-evaluation. *Second*, sample group organizations were asked to fill out Business Model Canvas template (Osterwalder and Pigneur, 2010) and describe in open-ended manner their current and future (2021) business model. *Third*, after several harmonization and coding iterations, Living Lab Business Model Canvas (LLBMC) survey tool was defined. The LLBMC tool development has previously been reported in-depth by Santonen and Julin (2018a, 2018b). In brief, the LLBMC tool includes a total of 101 variables ranging from 9 to 15 variables per BMC item, while measuring the relevance of the given attribute via Quality Function Deployment (QFD) 0-1-3-9 scale (Franceschini and Rupil, 1999). *Fourth*, quantitative data collection via LLBMC tool was conducted twice. The first data collection results has been previously reported by Santonen and Julin (2019). The second time data collection was conducted in conjunction with in-depth semi-structured interviews, which followed the themes defined in the LLBMC. The empirical results in this study are based on the second data collection phase. During the interviews, respondents were asked to review their quantitative selection and explain the underlying factors and drivers behind their business model selections. The interview results were transcribed and a conventional content analysis approach (Hsieh and Shannon, 2005) was applied in order understand the underlying factors influencing living lab business model. *Finally*, at the end of the project living labs were (1) reporting the main development activities conducted during the ProVaHealth-project lifetime, (2) comparing these to the self-evaluation report conducted in the beginning of the project, and (3) action plan to implement the planned future business model.

4 Results

4.1 Living Lab Business Model Strategy Evolution

In the Table 1, living labs 1-15 current and future business model strategies are compared as follows. Now and Future percent values are presenting each living lab relative position to a situation if they had selected all the 101 business model attributes as non-relevant (i.e. selected value zero resulting 0 % relative value) or highly important (i.e. selected value nine resulting 100 % relative value). Change is representing the magnitude of the relative change between future and current situation.

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Table 1 Living labs (LL) business model strategy evolution

Living lab name	*Now %*	*Future %*	*Change %*	*Change Sig.*	*Change Strategy*
LL1	64	68	4	**	Fine-tuning
LL2	76	81	5	*	Fine-tuning
LL3	20	28	8	***	Minor adj.
LL4	13	22	9	***	Minor adj.
LL5	44	53	9	***	Minor adj.
LL6	18	28	10	***	Minor adj.
LL7	31	41	10	***	Minor adj.
LL8	37	47	10	***	Minor adj.
LL9	71	83	12	***	Minor adj.
LL10	42	60	18	***	Rescoping
LL11	31	51	20	***	Rescoping
LL12	49	69	20	***	Rescoping
LL13	43	63	20	***	Rescoping
LL14	25	46	21	***	Rescoping
LL15	24	62	38	***	Frog leaping

* Sig. (2-tailed) at 0.05 level, ** at 0.01 level, *** at 0.001 level

Nonparametric pairwise Wilcox Signed Rank tests were applied to reveal the possible significant differences between the current and future strategies. The results revealed that all living labs strategies were about change their strategy in the future, but their approach for change was differing. The four change strategies reflecting the magnitude of change were named as follows: (1) *Fine tuning*, where the relative change between current and future model was less than 5 percent, (2) *Minor adjustments*, where relative change was ranging between 5 to 12 percent, (3) *Rescoping* where relative change was varying between 18 to 22 percent and (4) *Frog leaping* when relative change was more than 38 percent.

4.2 Change strategy impact on LLBMC attributes

Kendall rank correlation coefficient was calculated (Table 2) to identify which of the LLBMC attributes were influenced by change strategy. Due the small sample size (N=15) boot strapping was applied having confidence levels at 0.95 and number of samples being 2000. As result, it appears those living labs who are about make more significant changes currently considers device manufactures and digital services providers as less important customer segments. Device manufactures were also regarded as less important partners, and digital services providers as partners correlation barely stayed under the borderline. In all, the key partners as resources were also considered less important among those living labs who are planning to make more significant changes. These observations are important, since partnerships had a clear tendency to lead to customer relationship (bootstrapped correlations ranged from 0.488* to 0.850**) with the same customer segment type excluding tertiary healthcare organization (e.g. partnership with primary care organization will lead to customer relationship with primary care customer segment). The tertiary

partnership-customer relationship appears to be more complex, since bootstrapping results were not always significant, and therefore correlation could not be clearly confirmed.

Table 2 Bootstrapped Kendall rank correlation coefficient between LLBMC attributes and change strategy.

	BMC attribute type	*Attribute name*	*Kendall's τ*
	CURRENT BUSINESS MODEL		
1	Customer segment	Device manufacturers	-0.659**
2	Customer segment	Digital service providers	-0.719**
4	Partners	Device manufacturers	-0.653**
5	Activity	Product/service R&D and testing services	-0.752**
6	Resource	Infrastructure and technologies	-0.598**
7	Resource	Key partner	-0.552*
8	Customer relationship	Internal organization relationships	-0.626**
9	Value proposition	R&D Services	-0.511*
10	Value proposition	R&D and/or testing with real end-users	-0.640**
11	Value proposition	Customized and personalized services	-0.478*
12	Value proposition	Unique infrastructure	-0.607*
13	Value proposition	Ecosystem and project management	-0.671**
	FUTURE BUSINESS MODEL		
1	Customer segment	Device manufacturers	-0.591*
2	Partners	Device manufacturers	-0.594*
3	Customer relationship	Internal organization relationships	-0.481*
4	Channels	Online, mobile and social media	0.490*
5	Channels	Paid media promotion and marketing	0.501*
6	Resource	Key partner	-0.531*
7	Value proposition	R&D and/or testing with real end-users	-0.531*
8	Value proposition	Ecosystem and project management	-0.600*

* Sig. (2-tailed) at 0.05 level, ** at 0.01 level

The stabilized business model has influence also on technical infrastructure and facilities. Stabilized living labs appears to have more mature technical infrastructure and facilities, which is considered as an important resource and an enabler. These living labs are highlight more the R&D service activities, which is also reflected into multiple living lab value propositions. Managing ecosystem and project while offering customized/personalized R&D services and testing with real end-users in a unique infrastructure are the core elements of the stabilised living lab value proposition. Furthermore, the more stable living labs have more intensified customer relationship with

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their organization internal customers, since more stronger emphasis is also given to internal or hosting organization customer relationships e.g. by supporting internal projects.

In the future, the planned changes are not able to bring the *Fine tuners – Minor adjusters – Rescopers – Frog leaper* to same level regarding following LLBMC attributes. The more stabilized living labs are still having more emphasis on device manufactures as partners and customers. Partner are also still considered as more important resource and the internal customer relationships are highlighted more. At the value proposition level, the more stable living labs are also keeping their edge on collaborating with real-users and acting as an innovation ecosystem orchestrator and project manager. Interestingly, less stabile living lab are planning to utilize more the paid media promotion and marketing as well as online, mobile and social media channels. This observation makes sense, since they have to overcome their other weaknesses somehow.

4.3 Identification of explanatory factors based on interviews

The interview results revealed the following group of factors, which provides a better understanding of the living labs current and future business model choices.

Political environment. It became very evident that the changes in political environment can have a great impact on living lab operating environment and operational capability. When a new government having different political composition is coming to power, the funding structures between national vs. regional axis can change radically as it has happened for example in Denmark. Who is distributing funding on what political agenda dictates not only the overall amount of available funding, but also what kind of activities, topics and structures are supported. Thus, changes in political agenda can be an opportunity or thread for living lab operations. The discontinuous transitions between funding periods and new political agenda setting possess great challenges for living labs since their revenue models are mainly grounded on public funding. In worst cases discontinuous funding has led to personnel lay-offs and disintegration of project teams. The limited human resources due lack of funding then reduces the operational possibilities and in some cases have forced living labs to reform their teams periodically. During the project timeline, a non-profit living lab association having great operational independency and twenty years of experience on projects was merged into regional university. The lack of permanent funding and university need to have new resources and competences were the key drivers for a merger.

Regional vs. national structures. Regionally managed public funding can lead to silo effect and sub optimization, while at least in some cases national funding structure can better accelerate cross-regional and cross-disciplinary collaboration. However, regional and city driven approaches had resulted more tightly connect regional or local innovation ecosystem, which is boosting business opportunities for a living lab operating in this particular geographical area. Thus, we cannot argue that local, regional or national system per se is good or bad. All combinations were found among sample group living labs, each having a different impact and influence on the living lab activities. As a results, it is argued that the successful outcome is greatly depending on the execution, not merely on the geographical structure.

Geographical location. In all the geography and the local surrounding ecosystem appears to play a critical role in living lab operations. It seems that collaboration becomes more easy when different organizations or living lab environments are in close distance. This kind of setting has initiated cross-organizational and systemic level joint operational

procedures. This observation is not surprising since the phenomenon is well documented in prior literature (Santonen et. al. 2020). The composition of available local and regional ecosystem actors plays also a critical role. However, certain type organizations, such as university hospital and medical university are not operating in all regions or the distance within the region can be great. This will evidently weaken the opportunities to run e.g. tertiary care related living lab. Also a significant unbalance of resources between the regions can reduce the likelihood of getting projects. For example, capital regions in some countries are attracting majority of the projects and human resources, thus leaving other regions in less favourable position. On the other hand, capital region like the greater Helsinki region consists multiple living labs, which makes them direct competitors or coopetitors depending on the case. Operating in the remote region can help to get public funding especially in EU-countries, where cohesion or structural funding is available.

Hosting organization. In most cases the sample group living labs were operating within a larger hosting organization. The hosting organizations included (1) universities, (2) research organizations, (3) regional health authority or health provider and (4) local/regional/national clusters consisting various organization types. Since living lab is not the main business function of the hosting organization, its business model is subordinate to the host organization strategy. The strategies and organizational capabilities were varying greatly between different types of hosting organizations. For example, regional health authority or health providers have the advantage of having direct access to various types of end-users and real-life environments whereas universities and research organizations often have to getting touch with the end-users via intermediary. In turn, research driven living labs have better capabilities to do high quality research and in some cases they were actively developing own innovations via living lab approach. The identified cluster based local, regional and national models are trying to overcome these weaknesses by establishing multi stakeholder collaboration ecosystem. However, redemption of the networking benefits requires systematic collaboration procedures and wide representation of the all the key quadruple helix roles, which is not easy to achieve. For example the living lab grounded on national cluster was planning to apply a frog leap change strategy. Likewise the regional clusters were either planning to execute rescoping or minor adjustment change strategy. Apparently, the cluster based collaboration model requires a lot of time to evolve. Anyhow, it is evident that tight collaboration between different organization types is a mandatory requirement to achieve successful innovation ecosystem. Furthermore, it is important to remember that partnerships had the tendency to lead to customer relationship as well.

Market demand vs. supply driven living lab operations. The living lab projects can be initiated on the basis of market demand or supply driven needs. By market demand we are referring to a project, which is initiated e.g. due patients or healthcare professionals practical needs or idea. In fact, some of the living labs were acting as an organization internal “innovation agency” and were helping employees to further develop their ideas via living lab approach. Having such a roles in a large regional health organization evidently generates opportunities for establishing new projects. Supply driven approach on the other hand is referring to a testing need of SMEs or start-up who has developed a technical solution or prototype, which they want to test in real life environment. Importantly, the living labs participating in ProVaHealth project have had several encounters where the “almost” ready solutions intended for the testing were clearly outdated. Healthcare professionals were either already using much more sophisticated solutions or the need that the solution was planned to solve, had very low priority among the practitioners. The

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official validation of healthcare solution is very demanding process, which requires special expertise and infrastructure. Therefore, all living labs are not able operate in this field whereas e.g. a research organization based living lab having a long history of developing their own clinical solutions can develop competitive advantage and help companies to navigate in the regulation jungle. Anyhow, all living labs should have a clear strategy to support both market demand and supply driven living lab operations.

5 Conclusions

Partially sequential mixed method approach was applied to evaluate more in-depth what kind of business models living labs are following as well as identifying the underlying factors influencing the business model selections. All fifteen sample group health and wellbeing living lab organizations from eight different countries were about to change their business model strategy in near future. This indicates that the living lab business models are not yet stabilized and they are still searching the right formula to achieve a successful business model. The following four different change strategies were identified and named as follows: "Fine tuning", "Minor adjustment", "Rescoping" and "Frog leaping".

Those living lab who has been able to establish partner and customer relationship with device manufacturers and digital service providers, appeared to have more mature business model. It is argued that offering services to for-profit commercial companies forces living labs to get their act together. The more mature living labs are not shy about their capabilities and they value proposition emphasis more on having a unique infrastructure and ability to offer customized services while doing R&D and testing with real end-users. The role as an ecosystem and project manager is also underlined more strongly than among less mature living labs as well as utilizing key partners as a resource. In the near future, the more stabilized living labs are still going to keep their edge on collaborating with real-users and acting as an innovation ecosystem orchestrator and project manager. Less stabile living labs are planning to invest more on the paid media promotion and marketing as well as online, mobile and social media channel presence to overcome their weaknesses.

Political environment and changes in political power relations appears to have significant impact on living lab operations in many levels. The problems occurs especially when policies are changing radically, which happened also during the ProVaHealth-project duration. The radical political changes forces living labs to reinvent themselves. The problems cumulate when the political transformation causes delays or totally omits funding possibilities. Short term or pendulum polices are making long term planning difficult for living labs. Living lab geographical location plays also a critical role. In some cases geography can be seen as an enabler, while in other cases it can become a barrier. Thus, the future studies should investigate more in-depth the influence of the geography especially in terms of capital region vs. provinces. In living lab research, it is also often neglected the fact that living labs are not independent entities. Instead they are in most cases operating under different types of hosting organizations including universities, research organizations, regional health authority, health providers or clusters. Each of these have different kinds of strengths and weaknesses. However, it is argued that it is unlikely that living lab and its hosting organization can independently achieve a sustainable business model. More emphasis needs to be given to establish more systematic multi-stakeholder collaboration and evaluate how the collaboration maturity evolves locally, regionally, nationally and transnationally (Santonen et al. 2020).

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