



This is an electronic reprint of the original article. This reprint may differ from the original in pagination and typographic detail.

Please cite the original version: Santonen, T. & Julin, M. (2019) Empirical Evaluation of Health and Wellbeing Living Lab Business Models. In Iain Bitran, Steffen Conn, Chris Gernreich, Michelle Heber, K.R.E. Huizing, Olga Kokshagina, Marko Torkkeli, Marcus Tynnhammar (Eds.) Proceedings of ISPIM Connects Ottawa, Innovation for Local and Global Impact - 7-10 April 2019 - Ottawa, Canada. Lappeenranta: Lappeenranta University of Technology, LUT Scientific and Expertise Publications 91.

Empirical Evaluation of Health and Wellbeing Living Lab Business Models

Teemu Santonen*

Laurea University of Applied Sciences,
Vanha maantie 9, O2650 Espoo, Finland.
E-mail: teemu.santonen@laurea.fi

Mikko Julin

Laurea University of Applied Sciences,
Vanha maantie 9, O2650 Espoo, Finland.
E-mail: mikko.julin@laurea.fi

* Corresponding author

Abstract: Living Labs (LLs) are among the user-centred open innovation approaches. LL approach is highlighting RDI operations in the real-life environments together with end-users and other relevant stakeholders while utilizing various research and development methods across the different innovation process stages. The main aim of this study is to empirically identify and compare health and wellbeing LL current and future business models by utilizing empirical Business Model Canvas (BMC) approach. In total BMC survey instrument included 101 variables ranging from nine to fifteen variables depending on the BMC item. In all, fourteen LL from eight different countries send their self-evaluation response. The paper compares the similarities and differences at LL level as well as BMC item level. The results suggest that there is not a universal business model among the sample selection LL organisations.

Keywords: Living lab, Business model, Business model canvas, Health, Wellbeing, Baltic Sea,

1. Introduction

According to European Network Living Labs (ENoLL) –the international federation of benchmarked Living Labs in Europe and worldwide – Living Lab (later LL) or Living Labs (later LLs) in the plural form are grounded on multi-stakeholder participation and active user involvement which in real-life setting are utilizing multi-method approaches while co-creating novel solutions across the different innovation process stages (ENOLL, 2016). However, LLs themselves have been struggling to find sustainable business models and most of them rely mainly on public grants (Gualandi, and Romme, 2019). In all, the studies focusing on LL business models are rare (Rits et al. 2015), and in fact very little is known what kind of business models LLs are following.

The world's population is aging rapidly especially in Japan and some European countries (OECD, 2016) and this trend is expected to continue also in the forthcoming

decades. Aging population has significant socio-economic consequences especially for health and wellbeing systems, and therefore novel technological, service and business model innovations are in high demand within this particular industry. The health and wellbeing is also by far the most popular thematic focus area among ENoLL members and nearly half of the members are operating in this particular industry (see enoll.org for more information). Therefore, it suggested that from market demand point of view, there should be a plenty of opportunities to offer LL services for investigating the problem-solution and product-market fits and run successful business model (Coorevits et. al. 2018).

1.1 Objectives and Structure of this Study

The main aim of this study is to empirically identify and compare health and wellbeing LLs current and future business models by utilizing empirical Business Model Canvas (BMC) approach, which has recently been introduced by Santonen and Julin (2018a, 2018b).

This study is structured as follows: *First* we briefly present the theoretical background of the Osterwalder and Pigneur (2010) Business Model Canvas (BMC) approach, as well as the body of knowledge relating LL business models. *Second*, we present our research methodology and data collection process. *Third*, current and future health and wellbeing business models are presented and compared. *Finally* conclusions and suggestions for future studies are presented.

2. Living Lab Business Models

2.1 Business Model Canvas (BMC)

Business model innovation (Osterwalder, 2004) as a research domain is a relatively young phenomena, which gained a substantial boost especially among in the practitioner communities when the BMC was introduced (Osterwalder and Pigneur, 2010). Even if the prior literature reviews have argued that there is no overall definition for business model (Zott et al., 2011), generally speaking a business model is a method in which an organization builds and uses its resources to offer their customers better value than their competitors, and make profit by doing so (Afuah and Tucci, 2001). Besides the original BMC approach, multiple other canvas models have been proposed (e.g. Maurya, 2012, Zolnowski and Böhmman, 2014; Daxboeck, 2013, Joyce and Paquin, 2016), but evidently the original BMC has gained the most interest among the scholars.

The BMC approach (Osterwalder and Pigneur, 2010) includes the following nine building blocks, which are also forming the theoretical framework for our LL business model evaluation and comparison:

- 1) **Key Activities:** The most important things, which a LL needs do, to make its business model work and deliver the value for its customers.
- 2) **Key Resources:** The most important physical, financial, intellectual, or human assets.
- 3) **Partner Network:** By intelligently optimizing the partner (Howells et al. 2004) and network (de Man and Duysters, 2005) selection, LL can have an access to the

resources and capabilities, which they themselves are lacking in order to redeem the suggested positive effects of collaboration

- 4) **Value proposition:** Describes the benefits what customers can expect from a bundle LL services and products. Importantly, the benefits are in relationship to a specific customer segment.
- 5) **Customer Segments:** The various sets of people and/or organizations who share one or more attributes and to whom LL aims to reach and provide a set of services.
- 6) **Channels:** Different communication, distribution, and sales channels, which LL is using to reach and deliver its services for the customers.
- 7) **Customer Relationships:** An ongoing connection and management process for facilitating relationships and interactions with LL current and potential customers.
- 8) **Cost Structure:** Describes the most important financial consequences, which are incurred to execute the key activities and run the business model.
- 9) **Revenue Streams:** Several ways how a LL captures value and makes income from different customer segment by meeting their expectations.

2.2 Living Lab Business Models

While Rits et al. (2015) were describing the iMinds Living Lab approach and how the business model activities have overtime been integrated in every single steps of the LL process, they also collected all the contributions which so far have in some way addressed the LL business model topic. As a conclusion, they identified the following three main focus areas for LL business model studies:

- *First*, there are studies focusing on the multi-stakeholder driven collaboration (also often known as Quadruple Helix approach), arguing the lack of proper business model is a barrier to open innovate within LLs.
- *Second*, studies discussing how LLs can meet the market needs and generate enough revenues in order to become economically viable.
- *Third*, studies making blurry suggestions how LL projects could be used as a tool to identify novel business model opportunities.

In all most of the LL studies focusing on business modelling have more or less been grounded on single or combination of only few case studies. However, this is very typical when a particular research stream is still evolving strongly. In a previous study (Santonen, 2018) identified that Google Scholar is the by far the most extensive publication reference source for LL studies. When applying a search in the title of the article and having “living lab” and “business model” as keywords, the results will gain only four hits including the prior referred Rits et al. (2015) study. Partially by the same authors (D'Hauwers, et. al. 2015), a hypothesis driven theoretical living lab framework which incorporates user and business model learning was proposed on the basis of over 40 SME case studies. The remaining two publications are conducted by the authors of this study (Santonen and Julin 2018a, 2018b) and are basically focusing on the development of the BMC survey instrument.

To conclude, in our understanding this study is the first empirical effort, which aims to systematically compare and evaluate LL business model.

3 Research methodology

3.1 Data Collection and Response

The unit of analysis in this study is a health and wellbeing LL. The data is grounded on the self-evaluation of the 14 LLs from eight different countries, which are taking a part to the ProVaHealth-project. ProVaHealth project is funded by the Interreg Baltic Sea Region, which is a part of the European Regional Development fund. Country wise the dataset is including LLs from Estonia, Denmark, Finland, Germany, Latvia, Lithuania, Poland and Sweden. On the average, the LLs in this study have been operating ca. 6 years (ranging from 1 to 13 years).

The BMC survey instrument was developed and tested thru several iterations and is previously described in more detail by Santonen and Julin (2018a, 2018b). The data collection and survey development process in brief was as follows: *First*, all LLs filled open-ended BMC based on their current business model. *Second*, a set of individual variables for each of the nine BMC elements (i.e. key partner, activities, resources, value proposition, customer relationships, channels, customer segments, cost structure and revenue streams) were derived from the open ended responses by coding and then clustered similar items. *Third*, feedback loops between research team of two persons and project consortium members from 16 LLs was established in order to iterate the final set of variables. After few iterations, the validated BMC survey instrument including a total of 101 variables ranging from 9 to 15 variables per BMC item was defined.

Quality Function Deployment (QFD) 0-1-3-9 scale (Franceschini and Rupil, 1999) was utilized “highlighting” highly (9) /medium (3)-relevant variables more clearly, while lowering the scores of not (0) /weakly (1) -relevant variables. LL’s opinion regarding (1) the current state of the affairs and (2) the expected state by the end of the year 2021 were collected. As a result, 15 LLs replied for current state statements and 14 LLs for the future plans for year 2021. As result, our final dataset includes 14 LLs.

4 Results

In the following, the perceptions of the current and future business models are compared for all nine BMC items at the individual variable level. Each table presents the variables from high to low ranking order on the basis of current situation of participating LL (N=14). Furthermore, Wilcoxon Signed-Ranks test were applied to test, if variables relevance were expected to change in the future. In Sig. column, * presents that mean differences exact significance (2-tailed) is at the 0.05 level, while ** indicates 0.01 level significance. Thus, those variables marked with * or ** are expected to have greater relevance in the future, while for the remaining variables, future changes are non-significant even if there might be mean difference.

4.1 BMC Key partners

In the Table 1, the ranking order of the KEY PARTNERS are presented. Currently among the TOP 3, partners are (P9) Educational organizations (mean = 5.64), (P1) Research organizations (mean = 5.29) and (P11) Regional public organizations (mean = 4.93).

Table 1: BMC Partners (P) Now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
P9	Education organization	5.64	6.57	
P1	Research organization	5.29	6.71	*
P11	Regional public organization	4.93	5.93	
P3	Secondary care organization	4.64	5.50	
P10	Municipals and cities	4.50	5.79	
P13	Networks and clusters	4.36	6.50	*
P6	Tangible equipment and device manufacturers and industry partners	4.29	6.43	**
P4	Tertiary care organization	3.79	4.07	
P12	State level organization	3.79	4.00	
P2	Primary care organization	3.64	5.36	
P7	E-Health, M-Health and digital service providers and development companies	3.57	5.36	*
P5	Preventive healthcare, wellbeing and wellness service providers	2.86	4.64	*
P8	NGOs, NPOs and third sector organization	2.21	4.36	**

The relevance of the following key partner items are expected to increase in the future: (P1) Research organization (mean from 5.29 to 6.71) and thus making it the most relevant partner from LLs. The relevance of the (P13) Networks and clusters (mean increasing from 4.36 to 5.79), and (P6) Tangible equipment and device manufacturers and industry partners (mean from 4.29 to 6.43) are also emphasised more in the future and making them alongside with research and educational organizations, the most important partners for LLs. Also the relevance of (P7) the E-Health, M-Health and digital service providers and development companies (mean from 3.57 to 5.36), (P5) Preventive healthcare, wellbeing and wellness service providers (mean from 2.86 to 4.64) and (P8) NGOs, NPOs and third sector org (P8, mean from 2.21 to 4.36) are expected to increase. As a result, it is argued that there is a growing need for LLs to expand their partner network and especially to seek industrial partners and take more active role in the networks and clusters.

4.2 Key activity

In the Table 2, the ranking order of the KEY ACTIVITIES are presented. All the current TOP 3 activities are also expected to increase their relevance in the future as follows: (A3) Project management and coordination (mean from 4.86 to 6.00) will lose its leading position to (A2) Education and training services (mean from 4.57 to 6.43) and (A1) Product or service related R&D services including testing and development (mean from 4.08 to 7.62).

Table 2: BMC Activity (A) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
A3	Project management and coordination	4.86	6.00	*
A2	Education and training services	4.57	6.43	*
A1	Product or service related R&D services including testing and development	4.00	7.71	**
A4	(Innovation) ecosystem network management, facilitation and/or orchestration	3.93	6.14	*
A5	Grant writing and funding application support services	3.43	5.50	*
A10	Marketing and sales	2.79	5.00	**
A8	Support services to regional authorities	2.71	3.57	
A7	Support services to local municipal and city authorities	2.50	3.79	
A11	Final end-user services	1.86	2.64	
A6	Providing funding to applicants	1.57	2.43	
A9	Support services to state level authorities	1.14	2.57	

The relevance of the following other Key activity items are also expected to increase in the future: (A4) (Innovation) ecosystem network management, facilitation and/or orchestration (mean from 3.93 to 6.14) which will replace (A3) project management from the TOP3. Furthermore, also (A5) Grant writing and funding application support services (mean from 3.43 to 5.50), and (A10) Marketing and sales (mean from 2.79 to 5.50) expected to become more relevant. Especially, the latter observations suggest that LLs are planning to take more proactive role within their ecosystems and more aggressively market and sell their services while providing also hands on help to acquire public funding for its customers.

4.3 Resources

In the Table 3, the ranking order of the KEY RESOURCES are presented. Currently among the TOP 3 resources are (RE1) Permanent personnel (mean = 5.50), (RE4) Infrastructure and technologies (mean = 4.07) and in the shared third position (RE3) Students receiving study credits and (RE5) Partner(s) as defined in the key partner section (mean = 3.43).

Table 3: BMC Resources (R) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
RE1	Permanent personnel	5.50	6.71	
RE4	Infrastructure and technologies	4.07	6.29	*
RE3	Students receiving study credits	3.43	5.21	*
RE5	Partner(s) as defined in the key partner section	3.43	5.14	*
RE8	End-user and patients panel	3.36	5.64	**
RE7	External networks	3.21	5.00	*
RE2	Individual external experts	3.14	4.64	
RE6	Data databases and scientific publication databases	3.14	5.86	**
RE9	IPR portfolio	2.07	3.14	

The relevance of the following key resources are expected to increase in the future: (RE4) Infrastructure and technologies (mean from 4.07 to 6.29) and (RE6) Data databases and scientific publication databases (mean from 3.14 to 5.86). These findings highlight the increased importance to leverage from technical infrastructure as well as the ability interlink the LL activity results to prior findings or data. The permanent access to various (RE8) End-user and patients panels (from 3.36 to 5.64) is also apparently becoming more and more important. The prior identify LL desire to gain more proactive role within their ecosystem is also reflected to other kinds of resource needs. The importance increase relating (RE3) Students receiving study credits (from 3.43 to 5.21), (RE5) Partner(s) as defined key partner section (mean from 3.43 to 5.14) and (RE7) External networks (mean from 3.21 to 5.00) are indicating that the permanent personnel alone are not enough to satisfy the expected volume increase, which LL are aiming to gain via more aggressive and proactive marketing efforts.

4.4 Value proposition

In the Table 4, the ranking order of the VALUE PROPOSITION items are presented. Currently among the TOP 3 Value position items are (VP1) R&D services (mean = 5.57), (VP5) Unique infrastructure (mean = 5.29) and (VP2) With real end-users (mean = 4.57).

Table 4: BMC Value proposition (VP) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
VP1	R&D services	5.57	6.43	
VP5	Unique infrastructure	5.29	6.43	
VP2	With real end-user	4.57	5.79	
VP3	Various positive arguments	4.43	6.71	
VP4	Customized and personalized services	4.14	5.00	
VP9	Multidisciplinary	3.71	5.57	*
VP7	Funding support	3.64	4.71	*
VP10	Ecosystem and project management	3.50	4.79	
VP8	Value and impact evaluation	3.36	4.79	*
VP11	Education and training	3.36	4.86	*
VP6	Grant funding	2.93	3.79	
VP12	Method development	2.64	3.64	*
VP13	Marketing support	2.57	3.57	

The relevance of the following value proposition items are expected to increase in the future: (VP9) Multidisciplinary (from 3.71 to 5.57), (VP8) Value and impact evaluation (from 3.36 to 4.79), (VP7) Funding support (from 3.64 to 4.71), (VP11) Education and training (from 3.36 to 4.49) and (VP12) Method development (from 2.57 to 3.57). Besides multidisciplinary approach, which is one of the LL fundamentals, the need to provide funding support for LL customers is becoming more important also as a value proposition. This goes in parallel with value and impact evaluation, which are essential for LL to justify the quality of their services and methods, in which the latter is also under pressure to improve.

It is also noteworthy to mention, that at least some of the LL are also actively operating as educators and trainers and aligning their educational activities alongside LL activities.

4.5 Channels

In the Table 6, the ranking order of the CHANNELS items are presented. Currently among the TOP 3 items are (CH1) Co-operation projects (mean = 5.21), (CH4) direct channels (mean = 4.57) and (CH11) Regional channels (4.14).

Table 6: BMC Channels (CH) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
CH1	Co-operation projects	5.21	6.93	
CH4	Direct channels	4.57	6.00	
CH11	Regional Channel	4.14	4.64	
CH2	Educational channels	4.00	4.71	
CH7	Event participation	3.57	5.00	
CH14	Networks and Cluster	3.36	5.57	
CH8	Events arranged by LL	3.00	5.14	*
CH5	Professional publications	2.93	4.93	*
CH6	Peer reviewed scientific journals or conference publications	2.86	3.50	
CH13	Lobbying and Policy Channels	2.86	4.93	*
CH15	Owners or key partners channels	2.86	3.79	
CH10	Municipal and City Channels	2.79	4.50	*
CH3	Online, mobile and social media	2.36	4.86	*
CH12	State Level Channel	1.86	2.71	*
CH9	Paid media promotion and marketing	1.29	2.57	*

The relevance of the following channels are expected to increase in the future: (CH8) Events arranged by LL (from 3.57 to 5.00), (CH13) Lobbying and Policy Channels (from 2.86 to 4.93), (CH5) Professional publications (from 2.93 to 4.93), (CH3) Online, mobile and social media (from 2.36 to 4.86), (CH10) Municipal and City Channels (from 2.79 to 4.50), (CH12) State Level Channel (from 1.86 to 2.71) and (CH9) Paid media promotion and marketing, (1.29 to 2.57). The LLs strong linkage to public funding is also reflected.

4.6 Relationships

In the Table 5, the ranking order of the CUSTOMER RELATIONSHIPS items are presented. Currently among the TOP 3 items are (RS1) Long-term relationships (mean = 6.00), (RS5) Project based (mean = 5.71) and (RS4) Direct personal contacts (mean = 5.29).

Table 5: BMC Relationships (RS) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
RS1	Long-term relations	6.00	7.43	
RS5	Project based	5.71	6.57	
RS4	Direct personal contacts	5.29	6.29	
RS2	Networking	4.57	6.14	
RS3	Events	3.43	4.64	
RS7	Internal	3.43	4.14	
RS9	Co-creation with various stakeholders	3.29	5.86	**
RS6	Advisory	2.71	3.50	*
RS8	Steering	2.43	3.29	

The relevance of the following two customer relationships items are expected to increase in the future: (RS9) Co-creation with various stakeholders (from 3.29 to 5.86) and (RS6) Advisory (from 2.71 to 3.50). These observations are also in-line with stronger emphasis on the multidisciplinary value proposition, but also increased desire to strengthen collaboration with customer by acting a business advisory for potential customers (or vis-versa) which can open up either new funding possibilities or more sales.

4.7 Customer segments

In the Table 7, the ranking order of the CUSTOMER SEGMENTS items are presented. Currently among the TOP 3 items are (C9) Educational organizations (mean = 4.50), (C6) Tangible equipment and device manufacturers and industry partners (mean = 4.36) and (C11) Regional public organizations (mean 4.07).

Table 7: BMC Customer segments (C) now and in the future (2021) comparison results

	Variable description	Now	2021	Sig.
C9	Education org.	4.50	5.36	
C6	Tangible equipment and device manufacturers and industry partners	4.36	5.43	*
C11	Regional public org.	4.07	4.64	
C1	Research org.	4.00	4.64	
C10	Municipals and cities	3.86	4.79	
C7	E-Health, M-Health and digital service providers and development companies	3.64	6.07	*
C3	Secondary care org.	3.43	4.21	
C13	Networks and clusters	3.00	5.14	**
C2	Primary care org.	2.86	4.93	
C12	State level org.	2.64	2.93	
C4	Tertiary care org.	1.86	3.43	*
C5	Preventive healthcare, wellbeing and wellness service providers	1.57	4.14	**
C8	NGOs, NPOs and Third sector org.	1.57	3.00	*

The relevance of the following customer segment items are expected to increase in the future: (C7) E-Health, M-Health and digital service providers and development companies (from 3.64 to 6.07), (C6) Tangible equipment and device manufacturers and industry partners (from 4.36 to 5.43), (C13) Networks and clusters (from 3.00 to 5.14), (C5) Preventive healthcare, wellbeing and wellness service providers (from 1.57 to 4.14), (C4) Tertiary care organizations (from 1.86 to 3.43) and finally (C8) NGOs, NPOs and third sector org (from 1.57 to 3.00). Besides industrial customers who are developing digital or tangible solutions, also the clusters and networks are considered as more and more important customer segment. Furthermore, the opposite ends (preventive vs. tertiary) of the health and wellbeing domain, are both raising a profile as a customer segment.

4.8 Cost structure

In the Table 8, the ranking order of the COST STRUCTURE items are presented. Currently among the TOP 3 items are: (CS1) Personnel (mean = 7.43), (CS2) Infrastructure and facilities cost (mean = 3.79) and (CS9) Travelling costs (mean 2.64).

Table 8: BMC Cost structure (CS) now and in the future (2021) mean comparison results

Variable description	Now	2021	Sig.
CS1 Personnel	7.43	8.00	
CS2 Infrastructure and facilities cost	3.79	5.29	*
CS9 Travelling costs	2.64	3.21	
CS3 Consulting fees for individual external experts	2.36	3.21	
CS8 IPR protection	2.36	2.71	
CS5 Own internal R&D development	2.14	3.93	*
CS7 End-user fees and other variable costs relating LL Activities	2.00	3.57	*
CS4 Costs relating outsourced services	1.79	2.57	
CS6 Marketing and sales	1.79	3.64	**

The relevance of the following cost structure items are expected to increase in the future: (CS2) Infrastructure and facilities cost (from 3.79 to 5.29), (CS5) Own internal R&D development (2.14 to 3.93), (CS6) Marketing and sales (from 1.69 to 3.64) and (CS7) End-user fees and other variable costs relating LL activities (from 2.00 to 3.57).

4.9 Revenue streams profiles

In the Table 9, the ranking order of the REVENUE STREAMS items are presented. Currently among the TOP 3 items are (R1) Project grants (mean = 6.50), (R2) Fixed/Permanent funding (mean = 4.79) and (R8) Education and training Services (mean 1.79) which however is significantly less than the two first ones.

Table 9: BMC Revenue (R) now and in the future (2021) mean comparison results

	Variable description	Now	2021	Sig.
R1	Project grants	6.50	6.14	
R2	Fixed/Permanent funding	4.79	6.21	
R8	Education and training Services	1.79	2.50	*
R3	R&D project and consulting service sales	1.50	2.93	**
R7	Donations	1.50	2.07	
R6	Device and infrastructure rental	1.43	2.43	*
R9	Royalties	0.86	1.64	
R4	Event and site visit fees	0.79	1.71	
R5	Equipment and device retail	0.43	0.57	

The relevance of the following Revenue sources are expected to increase in the future: (R3) R&D project and consulting service sales (from 1.50 to 2.93) (R8) Education and training Services (from 1.79 to 2.50), and (R6) Device and infrastructure rental (from 1.43 to 2.43).

4.10 Comparing Living Lab business models

In the Figure 1, all significant (sig. at least at the 0.05 level, 2-tailed) Pearson correlation coefficient are presented for current (left side) and future (right side) business models in order to reveal the similarities and differences between the fourteen LLs. In the illustration, upper part of the matrix is presenting a pie chart, which visualizes the correlation strength. In the lower part, the r values are presented as two-digit numbers. Furthermore, the dark blue colour indicates a high positive correlation, while the dark red colour a high negative correlation.

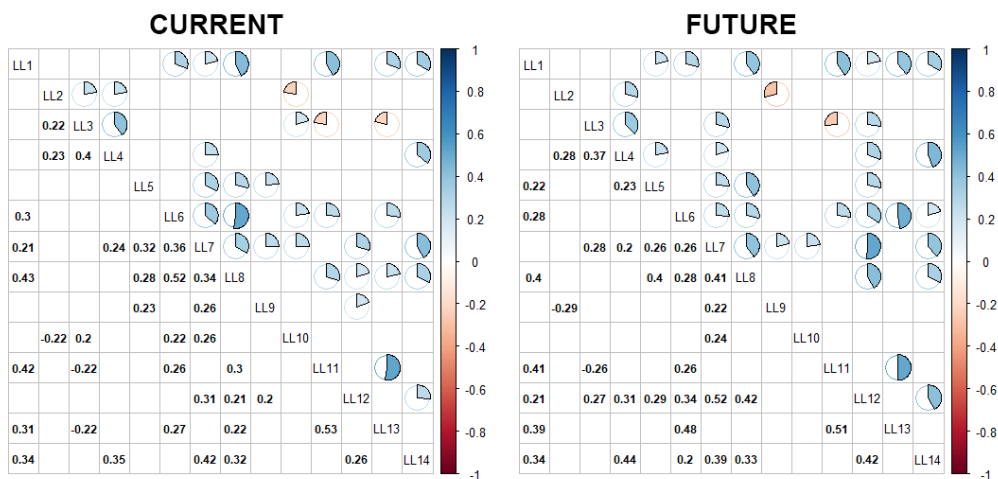


Figure 1: Significant correlations between LL's current and future business models

As a result, we can see that, in fact there are mainly weak (min being 0.200*) and moderate (max being 0.529**) positive correlations among the sample selection LLs. Interestingly, also three negative correlations can be found for the current situation and two negative correlations for the future situation, which indicates that these given LLs are taking opposite directions regarding their business model. Basically the above correlation results presented in the Figure 1, empirically validates that the fourteen LLs are following somewhat different business models, even if some similarities between them can be identified.

Obviously, the empirical evaluation at the nine BMC building block level reveals more stronger correlations between the LLs (table omitted) and correlation coefficient are ranging from moderate to strong in this case. The revenue streams and cost structures are the most similar BMC blogs among the sample selection, but even then, only 17 correlations (18.7 % of all possibilities) between the fourteen LLs were identified for the both of these BMC blogs. In the case of key partners, key activities, key resources, value proposition and customer relationship, in all six significant correlations are detected. Channels strategies are a bit more homogenous among LLs since eight correlations are detected. Finally, only three significant correlations can be detected in the case of customer segments, which highlights that each of the LLs are following a different kind of customer strategy.

5 Conclusions

This is the first study, which goes beyond case study approach, while trying to empirically compare the current and future LL business models. By using a data from fourteen different LLs from eight different country, the study validates the suggested BMC survey instrument's usefulness for evaluating and differentiating business models among LLs. Furthermore, the results also empirically validates the prior assumptions, which argue that LLs can have multiple embodiment. In fact, even if there was relatively strong positive correlation (from 0.563** to 0.885**) between individual LLs current and future business models, the business models are not one-to-one when comparison is made between the sample selection LLs. In all, the participating LLs seem to be still trying to discover a more sustainable business model, since significant changes are in the close time horizon.

However, the need for change is not divided equally among the investigated BMC blogs. Stronger industrial partnerships are highlighted, as well as a desire to gain more preventative healthcare, tertiary, digital and tangible manufactures and service providers as clients. These goals are requiring LLs to take more proactive role as ecosystem facilitator, and to help their clients gain public funding while expanding their channel selection to reach out for the current and new customers. Our results indicate that the LL personnel alone is not going to be enough to fulfil these goals. A need to utilize more resources beyond permanent personnel and emphasising multidisciplinary co-creation approaches have higher relevance in the future. The project and fixed funding are still expected to dominate as the key revenue streams, but other sources such as project, consulting, education, training and rental services sales are slowly increasing their importance as complimentary revenue source. Furthermore, in order to redeem the expected benefits, LL are seeking to more closely evaluate the provided value and impact and develop their own methods. These will not come for free to LLs. Infrastructure and facilities costs as well as marketing/sales and variables costs relating LL activities are under

pressure. Finally, the LLs are now following diverse business models, which also in the near future, are not going to be emerged as a universal offering. Importantly, developing a transnational LL approach is one of the main objectives of the ProVaHealth-project in which the sample selection LLs are taking a part. The transnational LL approach has also been under discussion already many years within ENoLL community. The results of this study suggest, that defining a transnational approach, which will satisfy all the participating LL might be difficult, since there is only a little common ground between these LL actors. Nevertheless, this might also open a door for a transnational LL approach, which instead of offering overlapping services could be based on a complimentary approach. In this approach, each LLs have more unique role, to whom the LLs are feeding the customers which they cannot serve.

This study has following limitations. The dataset included only health and wellbeing LLs, so one must be careful when trying to generalize these results to other LLs. The BMC survey instruments is also fine tune to this particular LL segments. Therefore, additional efforts are needed to develop similar instruments to other LL domains.

References and Notes

- Coorevits, L., Georges, A., & Schuurman, D. 2018. A Framework for Field Testing in Living Lab Innovation Projects. *Technology Innovation Management Review*, 8(12): 40-50.
- D'Hauwers, R., Rits, O. and Schuurman, D., 2015. A hypothesis driven tool to structurally embed user and business model research within Living Lab innovation tracks. In *Open Living Lab Days 2015*.
- ENoLL. (2016). Introducing ENoLL and its Living Lab Community. Retrieved from <https://issuu.com/enoll/docs/enoll-print>
- Franceschini, F. and Rupil, A., 1999. Rating scales and prioritization in QFD. *International Journal of Quality & Reliability Management*, 16(1), pp.85-97.
- Gualandi, E., & Romme, A. G. L. (2019). How to make living labs more financially sustainable? Case studies in Italy and the Netherlands. *Engineering Management Research*, 8(1), 11-19.
- Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, 1474-1486.
- OECD. *OECD Factbook 2015-2016: Economic, Environmental and Social Statistics*. Paris: OECD Publishing; 2016. DOI: 10.1787/factbook-2015-en
- Osterwalder, A. (2004). The business model ontology: A proposition in a design science approach.
- Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons.
- Rits, O., Schuurman, D., & Ballon, P. 2015. Exploring the Benefits of Integrating Business Model Research within Living Lab Projects. *Technology Innovation Management Review*, 5(12): 19-27.
- Santonen, T. (2018) Comparing Living Lab(s) and its' competing terms popularity in ISPIM Publications in the proceedings of the 2018 ISPIM Innovation Conference (Stockholm): Innovation, the Name of the Game in Stockholm, Sweden on 17-20 June 2018. Editors: I. Bitran; S. Conn; K.R.E. Huizingh; O. Kokshagina; M. Torkkeli; M. Tynnhammar. LUT Scientific and Expertise Publications, Reports

Santonen, T. and Julin, M., 2018a, June. Identifying Health and Wellbeing Living Lab Business Model Attributes. In ISPIM Innovation Symposium (pp. 1-13). The International Society for Professional Innovation Management (ISPIM).

Santonen, T., Julin, M. (2018) Identifying Health and Wellbeing Living Lab Business Model Attributes in the proceedings of the 2018 ISPIM Innovation Conference (Stockholm): Innovation, the Name of the Game in Stockholm, Sweden on 17-20 June 2018. Editors: I. Bitran; S. Conn; K.R.E. Huizingh; O. Kokshagina; M. Torkkeli; M. Tynnhammar. LUT Scientific and Expertise Publications, Reports

Santonen, T., Julin, M. (2018) Comparison of Health and Wellbeing Living Lab Business Models – Preliminary result based on Business Model Canvas Evaluation, OpenLivingLab Days 2018 conference, Research and Innovation Conference Proceedings, European Network of Living Labs (ENoLL)