TOWARDS A LIVING LAB FOR PROMOTING THE DIGITAL ENTREPRENEURSHIP PROCESS

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ABSTRACT

Digital entrepreneurship is defined as the reconciliation of traditional entrepreneurship with the new way of creating and doing business in the digital era. This paper develops a framework for a specific type of Living Labs for promoting the digital entrepreneurship process, called PDEP-LL (Promoting Digital Entrepreneurship Process Living Lab) that begins with the idea generation and continues with different business management stages. In order to foster university- entrepreneur partnerships, the objective of the PDEP-LL is to provide services for several types of academic and industrial stakeholders in the digital business ecosystem for supporting entrepreneurs and start-up businesses. This Living Lab serves as a foundation for activities and their digital artefacts involved of each entrepreneurial stage, for different associated digital platforms and for professional support services.

Keywords: Living Lab, Digital Entrepreneurship, Start-up, Business Development, Action Design Research.

INTRODUCTION

Decades ago, when the Internet and information technology and communication (ITC) were still unknown for almost everyone Casson (1982) suggested that a successful entrepreneur should focus on the use of information in a relevant fashion. Entrepreneurship contributes positively to employment, economic growth and innovation in a host country (Kuratko, 2005). However, fostering entrepreneurship is a long way to go since potential people always hesitate to become entrepreneurs (Doern & Goss, 2013). Thus, they have to face many difficulties in their entrepreneurial process (Kasabov, 2015); consequently, they need supports, especially from academic community and experts who are professionally knowledgeable, experienced and conversant with the market and environment. Furthermore, entrepreneurship in the digital economy must use electronic commerce by exploiting the Internet and electronic networks for their business opportunities. In the university settings, entrepreneurial knowledge and digital competence are the most important factors in promoting academic entrepreneurship (Scuotto & Morellato, 2013).

To join the traditional entrepreneurship with the new digital technologies in a novel way, the paper proposes a Living Lab that serves as a foundation for a digital ecosystem for promoting the digital entrepreneurship process. Given that the research addresses this new means of entrepreneurship and the Living Lab approach is still in its infancy, this paper sheds light on the value co-creation aspect of a digital ecosystem. Based on a conceptual research approach, the primary focus of this paper lies in exploring the digital entrepreneurial process that provides detailed insights into different aspects of its organization. Correspondingly, the paper proposes a

framework for elaborating a specific type of Living Labs for promoting the digital entrepreneurship process, hereafter called PDEP-LL (Promoting Digital Entrepreneurship Process Living Lab). To the best of the authors' knowledge, this is one of the first papers based on Living Lab approach for entrepreneurial processes supporting in this field.

The rest of this paper is structured as follows. The paper continues with the literature review of the digital entrepreneurship and the current trends related to Living Lab studies and to university-entrepreneur partnerships. Thus, the research design based on the action design research is presented. Accordingly, the conceptual framework for elaborating the PDEP-LL is introduced according to the research stages. The paper ends with the conclusion, the limitations and the direction for future research.

LITERATURE REVIEW

Digital Entrepreneurship and Entrepreneurial Process

Dutot (2015) argued that, entrepreneurship is described as a process in which entrepreneurs take from opportunity recognition to established business to harvesting the rewards of hard work, through sale or closing down or continued success (or well-earned experience). Indeed, there have been many studies on this subject; that mainly focus on entrepreneurs (Hampel-Milagrosa, Loewe & Reeg, 2015; Mas-Tur, Pinazo, Tur-Porcar & Sánchez-Masferrer, 2015; Picken, 2017; Schoon & Duckworth, 2012; Storti, 2014); on entrepreneurship support systems/entrepreneurship environments (Baltar & de Coulon, 2014; Bhave, 1994; Klonek, Isidor & Kauffeld, 2014); and on small businesses in start-up period (Gundry & Buchko, 1996; Wisniewski, 2013). However, those studies mostly focused on the factors that influence the entrepreneurship rather than accompany all stages of the entrepreneurship process.

The digital economy observes an increasing number of entrepreneurs participate in the sharing and exchange of information, knowledge, data and physical goods (Botsman & Rogers, 2011). The new generation of Web applications and social networks have facilitated the sharing of common resources, providing structures for new digital platforms and infrastructures that promote swapping, sharing and lending new business models (Bilgram, Brem & Voigt, 2008; Trumm, Kemper, Kern & Naumann, 2013). Online sharing can therefore be considered as a successful business model in the digital economy (Denning, 2014). Strategy for start-ups is usually to apply efficiently ITC, which plays a crucial role in managing and controlling production and business operations. In this regards, Baloh, Desouza & Hackney, (2012) confirmed that ITC applications allow to increase the productivity of a business by improving its competitiveness in the new era of globalization. This leads to a tremendous change in business environments in the digital economy that provides numerous special opportunities for entrepreneurs in different business areas (Hull, Hung, Hair, Perotti & DeMartino, 2007). Digital entrepreneurship is a field of entrepreneurship in which the new technological instruments such as the Internet and ICT have been fundamentally utilized for businesses (Rashidi, Yousefpour, Sani & Rezaei, 2013).

Hence, it is critical to study the digital entrepreneurship process, including all start-up stages, to understand and overcome the entrepreneur barriers (Klonek et al., 2014). In this regard, we summarize in Table 1 below the entrepreneurship stages mentioned in the different studies.

Table 1
ENTREPRENEURSHIP STAGES IDENTIFICATION

Authors	Stages Identified
Yaghoubi, Mahdi, Amir and Ebrahim (2012)	(1) Recognizing and seizing opportunities; (2) Transforming opportunities to marketable goods and services; (3) Adding value to goods and service through time and resources; (4) Assuming risk; and (5) Realizing reward
Van Horne, Huang and Al Awad (2012)	(1) Recognizing opportunities; (2) Assembling resources; (3) Launching of venture; and (4) Harvesting and succeeding
Bygrave, (1993); Cornwall & Naughton (2003)	(1) Identify and evaluate cognitive opportunities and (2) Gather the resources necessary for the business start-up in order to pursue and capture these opportunities
Bhave (1994)	(1) Opportunity identification; (2) Technology set up; (3) Organization creation; and (4) Exchange
Asghari and Gedeon (2010)	(1) Pre-seed; (2) Seed; (3) startup and (4) expansion/exit
Gruber (2002)	(1) Pre-startup (opportunity identification and evaluation); (2) Initial stage (business plan; resource collection) and (3) Initial development (enterprise building and market penetration)
Baron (2004); Hisrich and Peters (2002)	(1) Selecting workable idea; (2) Assembling necessary resources; and (3) Officially developing a new business
Rwigema and Venter (2004)	(1) Identifying and measuring an opportunity from multiple ideas; (2) Formulating a business plan; (3) Marshalling the resources; (4) Organizing and mobilizing resources; and (5) Overseeing the new venture creation and growth

Living Lab as an Open Innovation Ecosystem

Today, ITC plays an indispensable role in the production of successful entrepreneurship. ITC applications increase productivity and improve the competitive capacity (Baloh, Desouza & Hackney, 2012). On the other hand, Living Labs as a network for action research, including the university and the community, requires that the members of the network work closely together to deal with the problems they are facing (Howell, 2013).

In fact, the globalization and ITC lead to the radical changes in the business environment. For improving their performance, enterprises need to have an open and digital User-centred ecosystem, which can allow them to speed up the co-operation with their partners and customers in value creation. In this new ecosystem, enterprises co-create values by providing products and services for the market; then, customers will continue the value creation process by using and evaluating the products and services (Pallot, 2009). Enterprises can use the ideas from both inside and outside resources to create values in an open ecosystem (Vargo, Maglio & Akaka, 2008). As

such, with this ecosystem, members can cooperate and compete with one another to improve their capacity, support new products, meet customer needs and start new renovation cycles (Henry, 2006).

The Living Lab approach aims at taking a developmental view of innovation and at studying novel technologies in complex real-world settings that have realized the shift towards the active role of users as co-innovators (Higgins & Klein, 2011). For example, the Beer Living Lab project in Netherland evolved through a number of stages, such as initiation, analysis, redesign, pilot and evaluation, brought together representatives from business, government, technology providers and academia to develop innovative procedures for export of excise goods (Rukanova et al., 2011). In Finland, Autere, Korpela & Augustinussen (2011) point out to a process that redesigns customs declaration processes to improve the cost efficiency of SMEs by removing extra work.

Stahlbröst & Holst (2012) point out that the creation of innovative services is a difficult process for small and medium enterprises (SMEs) because they do not have enough necessary resources and capabilities. Living Lab approach can help all stakeholders to improve the business processes, from the upstream suppliers to the end users, with the special attention to SMEs and their potential customers in the digital environment. Aversano et al. (2016) note that there are four types of Living Lab that can help achieve this goal. First, the business Living Lab that focuses on a practical venue to invite stakeholders (e.g. citizens) to co-innovate. Second, the organization Living Lab that allows the members of an organization co-creates and grows. Third, the intermediate Living Lab that allows different partners to collaborate in a range of innovative activities. Finally, time-limit Living Lab facilitates the innovation process as a project and it ends when the project is completed.

Furthermore, Howell (2013), Dubé et al. (2014), Le Dinh, Vu, Phan & Nomo (2016) contend that Living Lab projects include specific activities, such as diagnosis, research, testing, evaluation and dissemination. While the diagnosis activity deals with the users' needs and wants and analyses the beneficiary's ability for identifying the co-creation process and proposed solutions, the *research activity* tends to determine new market opportunities and new ways of using products or services. On the other hand, while the *testing activity* requires the development of a validation environment so that users can experience in development of products and services, the *evaluation activity* aims at better understanding the user test and experiencing with the product or service that has been developed comprehensively. As for the *dissemination activity*, it allows different Living Lab stakeholders and the communities to share new knowledge and understanding. In this setting, it then appears that enterprises need to have an open, innovative and user-centric ecosystem that allows them to develop a co-creation process to reach a better performance.

University-Entrepreneur Partnerships

While the main mission of universities is knowledge creation and diffusion through teaching, research and services, the ultimate goal of an entrepreneur is to improve strategic positioning of his enterprise or to improve its profitability. The partnership between universities and entrepreneurs will be valuable if it helps each party to attain their goals (Suntornpithug & Todorovic, 2015). Entrepreneurs, who can bring the expertise of universities to their business, may find significant opportunities to collaborate effectively for innovation (Sherwood, Robinson & Butts, 2011). One of the critical sets of skills to which the entrepreneurial executive must consider is how to transfer successfully the knowledge from the university to the firm. To achieve that goal,

Arroyo-Vázquez, Sijde & Jiménez-Sáez (2010) develop a framework that encompasses entrepreneurship culture, entrepreneurship support, new business launch support and business growth support that can be used to identify clearly the mechanism and the optimal timing to satisfy the entrepreneurs and business demands. Additionally, Sherwood et al. (2011) provide a framework through which a collaborative knowledge could be successfully transferred from a university to a company. Recently, Suntornpithug & Todorovic (2016) have presented a case study about the trust-building process for connecting academia and entrepreneurs.

In this optic, Knotts (2011) reviews some entrepreneurial learning models in United States, which are used in some Small Business Development Centres (SBDC) that offer student consulting services for businesses, with topics ranging from business planning to logistics to human resources. At the Wharton SBDC, undergraduate students assess business problems, conduct industry research and present their findings (On the Job Learning). Temple University offers similar students consulting services at the graduate level (QS Top, MBA), while Drexel University focuses on non-profit consulting by top undergraduate students (Business Consulting). While many colleges have projects like the ones described above, it is unclear how many of these universities utilize the SBDCs to the extent described in this paper, with participation in multiple entrepreneurship courses at different stages of the entrepreneurial process. Several concluding remarks were synthesized: Each of those projects focuses on a specific level of the entrepreneurial process so that students can benefit not only knowledge about entrepreneurship but also apply it in the real context. By that way, students have good opportunities to engage in the entrepreneurship process, in particular, the activities related to idea evaluation, business planning and operation assessment.

In Canada, the University of Waterloo proposed a conceptual model for a virtual environment to support entrepreneurship called Jamii Incubator. The Jamii platform is built around three major activities referred to as event gates: An online pitch competition, a virtual investor pitch and a virtual 'investment committee' competition. To explore the platform and the event-gate approach, the University of Waterloo's Conrad Centre is collaborating with Strathmore University in Nairobi, Kenya, in an entrepreneurship challenge built around the Jamii platform ('Jamii' is Swahili for community). The collaboration and pilot program have provided an opportunity to explore the application of a virtual environment to support distance delivery of entrepreneurship education (Douglas, Karin & Mark, 2016).

RESEARCH DESIGN

This paper combines information system research and business development research to propose a framework for elaborating the PDEP-LL that aims at promoting the digital entrepreneurship process. The PDEP-LL can be considered as a digital infrastructure, a special IT artifact that is defined as digital technology tools and systems that offer communication, collaboration and computing capabilities to support innovation and entrepreneurship (Nambisan, 2016).

Therefore, the research method suggested for this research is *action design research* (ADR) (Sein, Henfridsson, Purao, Rossi & Lindgren, 2011). ADR is a research method for generating prescriptive design knowledge through building and evaluating ensemble IT artifacts in an organizational setting that focuses on two challenges: i) Addressing a problem situation encountered in a specific organizational setting by intervening and evaluating; and ii) Constructing and evaluating an IT artifact that addresses the set of problems typified by the encountered situation.

The stages of the ADR are presented in Figure 1 (Sein et al., 2011). The *problem formulation stage* identifies and conceptualizes a research opportunity based on existing theories and technologies in the literature. The *build, intervention and evaluation stage* (BIE) focus on generating the initial design of the Living Lab, which is shaped by organizational use and subsequent design cycles. The *reflection and learning stage*, which is a continuous stage and parallels the first two stages, moves conceptually from building a solution for a particular application to applying that learning to a broader set of problems. Finally, the *formalization of learning stage* formalizes the learning so that the situated learning from an ADR project should be further developed into general solution concepts for a set of field problems.

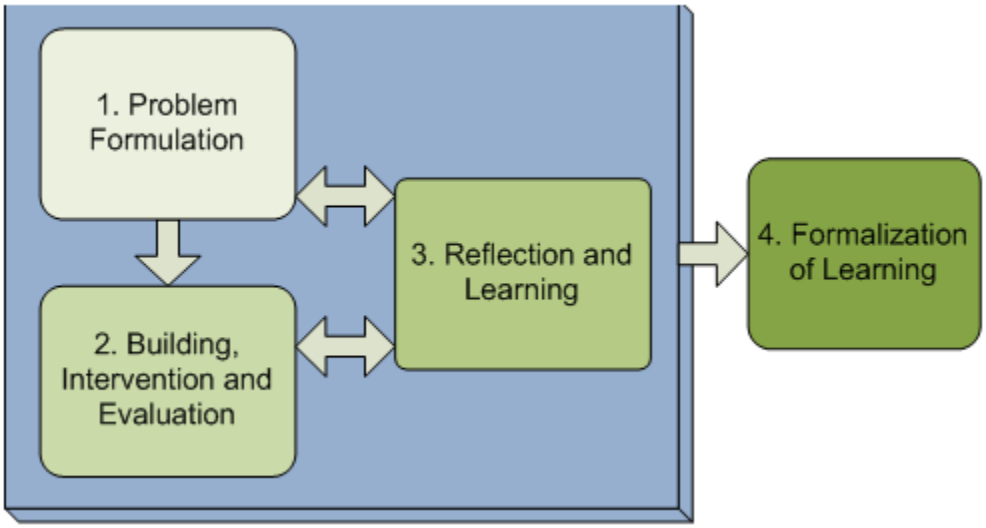

FIGURE 1
STAGES OF ACTION DESIGN RESEARCH

Problem Formulation

As mentioned above, there is a need for a renovation ecosystem in order to promote the digital entrepreneurship process and continuously improve the operational efficiency of enterprises in the digital era. This research aims at elaborating the PDEP-LL to mobilize the contributions of community and of users in carrying out an experiment against a practical background and encouraging co-operation among the parties. For that reason, this Living Lab allows to improve startups' the operational efficiency by boosting their business performance.

The research question is: "*How to elaborate a Living Lab for promoting the digital entrepreneurship process?*"

In order to explore a framework for elaborating the PDEP-LL, the research question involves the following sub-questions that correspond to different elements of the framework:

1. Who are stakeholders of the Living Lab? What are the key operations of a Living Lab? What are the determinants for evaluating the Living Lab?
2. What is the efficient digital entrepreneurship roadmap for start-ups and SMEs?
3. How does the Living Lab work? What is the Living Lab model for supporting the digital entrepreneurship roadmap to assure entrepreneur's confidence and success?

The proposed framework, which is based on the principles of Living Labs (Dubé et al., 2014) must meet the main objective of promoting the digital entrepreneurship by fitting the characteristics of start-ups. As a digital infrastructure, the PDEP-LL must also be serviced oriented infrastructure, which is constructed based on the information-driven framework for designing service-oriented systems (Le Dinh & Pham Thi, 2012; Le Dinh, Vu, Phan & Nomo, 2016).

The objective of the PDEP-LL project is to elaborate a Living Lab as a digital infrastructure for supporting the digital entrepreneurship process and for experimenting with students in business administration before exploiting it largely for local entrepreneurs and SMEs. The team for elaborating the Living Lab is composed of researchers in information systems and in business administration at the Business School at the Université du Québec à Trois-Rivières (UQTR), Canada.

BUILDING

Building, Intervention and Evaluation

As an ecosystem, the PDEP-LL supports the generic economic entities such as Utilizer, Enabler, Provider and User (Anna Ståhlbröst, 2008; Eriksson, Niitamo & Kulkki, 2005; Sarjanen, 2010). *Utilizer* is entrepreneurs or SMEs. *Enabler*, which creates the general infrastructure and policies to allow the Living Lab to operate, is indeed the UQTR and local business development organizations. *Provider* promotes business start-ups and continuous performance improvement, including academia (researchers and students) as well as emerging technology and service providers. *Users* are the public or the local social community that is the driving force for innovation in the Living Lab's environment.

Start-up founders, entrepreneurs, business managers are direct beneficiaries from the PDEP-LL. During the business creation phase, they can exchange ideas or can be advised against their business plan and business processes. During the business operation phase, with community managers and advisory groups of the PDEP-LL, they can join and co-analyse their business performance, forecast their opportunities and challenges. They can also get solutions for managing better their business to ensure continuous effectiveness. Besides the direct beneficiaries, the social community will also benefit from the project thanks to the sustainable development and corporate responsibility since the Living Lab approach minimizes the consequences of business failure or bankruptcy.

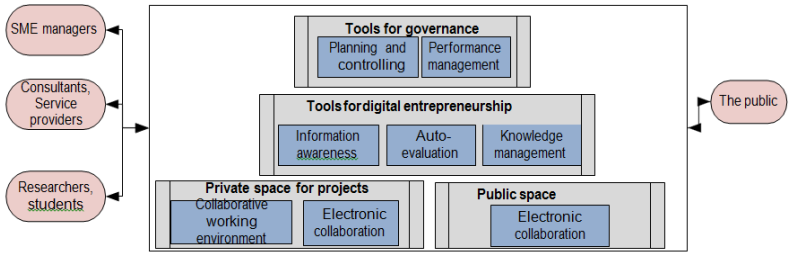

FIGURE 2
OVERALL STRUCTURE OF THE PDEP-LL

Figure 2 presents the overall structure of the PDEP-LL. *Information awareness* tool allows users to monitor the news, developments and trends in their business environments. *Auto-evaluation* tool helps users to evaluate their entrepreneurship decisions. *Knowledge management* tool captures, organizes and shares information and knowledge, which could be helpful for entrepreneurs and SME managers. *Public space* allows users to share and discuss their business ideas with the others; meanwhile, *private space* is reserved for each team to collaborate and work on their own projects. At the highest level, the *planning and controlling* and the *performance management* tools help entrepreneurs and SMEs to manage their projects efficiently and effectively.

INTERVENTION

Living Labs contribute to pushing up the creative management process and boosting the partnerships among the different economic entities at different entrepreneurship stages. Hence, the objective of this paper is to propose a framework for the PDEP-LL and apply the framework for supporting the activities of the digital entrepreneurship process.

In this research, we, firstly, study and analyse the literature and conduct some expert interviews. We made a literature review on entrepreneurship, on Living Lab studies and Living Lab's roles and applications for promoting the digital entrepreneurship process. We collected documents into two groups, including: i) Basic guidance documents on elaborating and managing a Living Lab; and ii) Documents about start-ups, Living Labs and the role of Living Labs in promoting the digital entrepreneurship. As results, we identify the key participants and the main activities of Living Labs. We also identify the principal digital artifacts, which are defined as digital components, applications or media contents that offer a specific functionality or value in the digital entrepreneurship process (Nambisan, 2016). Thus, we propose the framework by combining those elements and the entrepreneurship roadmap with appropriate adjustments.

In addition, we also use the methodology of group discussion. The participants are a group of four-year and five-year start up entrepreneurs. Hence, we get more ideas to improve the framework and to test whether the framework fits to the real-world situations or not. The questions that we have discussed are mainly open-ended ones, including: (1) What is the entrepreneurship stages they have gone through? (2) What are the difficulties and reasons for hesitation at each stage? (3) Who are the individuals and organizations that they desired the support for each stage? What are entrepreneurs' views of the ITC support? (5) Does the framework meet the requirements of a basic Living Lab?

We then build and standardize the digital entrepreneurship roadmap, including three entrepreneurship steps. Simultaneously, we create a model of interactions among specific stakeholders in the digital ecosystem supporting by the PDEP-LL on the basis of a start-up entrepreneurial spirit. In addition, we conduct the second group discussion with another group of less than three-year entrepreneurs in order to gather further necessary ideas and requirements for the framework.

EVALUATION

Living Lab acts as an intermediate for innovative co-operation (Bakici, Almirall & Wareham, 2013). To evaluate the PDEP-LL, it is essential to take into account the following elements such as: i) Key stakeholders of the Living Lab, ii) Important principles of Living Labs and iii) End-users experience.

Stahlbrost & Holst (2012) identified the four main stakeholders involving in the Living Lab, including enterprises, users, public organizations and researchers. These stakeholders benefit from the Living Lab in many ways. The *enterprises* get the innovation ideas they want; the *users* get the innovative product or service; the *researchers* can conduct researches; and the *public organizations* get the investment return on innovation research.

To run successfully a Living Lab, the researchers point out five core principles of Living Lab design, namely: Value, influence, sustainability, openness and practice (Stahlbrost, 2013). Firstly, superior value supply to customers is very important for business success. Secondly, customers must be considered as active and professional partners for the innovation and development. Thirdly, a Living Lab takes responsibility for the impacts on environment, society and economy. Fourthly, open co-operation among the partners with the differences of opinion, knowledge and experience is required. Finally, innovative activities must be conducted in a natural and practical environment.

A Living Lab environment should focus on reaching the users who wish to participate throughout the innovation process. Any Living Lab should be accessible to multi-context environments as well as advanced technology and infrastructure for supporting the different activities such as user engagement, technology development and testing. Each Living Lab environment should access to a variety of expertise in the relationships with different partners. In addition, it is important to ensure the core principles outlined above when governing the Living Lab.

REFLECTION AND LEARNING

Reflection

This stage emphasizes that the framework will reflect not only the preliminary design created by the team but also its on-going shaping by organizational use and participants (Sein et al., 2011). This reflection has been done in four semesters from fall 2015 to winter 2017 with the students in business administration at UQTR (about 40 students per semester) that took the course about new applications of information technology and communication. In order to foster academic entrepreneurship (Paco et al., 2017) and to simulate the digital entrepreneurship process, the course aims at reaching the following objectives: Defining, carrying out and governing an entrepreneurship project (Table 2).

Table 2

DESCRIPTION OF THE REFLECTION PROCESS

Objectives	Digital artefacts	Corresponding to the digital entrepreneurship roadmap
Defining an entrepreneurship project	Business occasion evaluation Business model/plan Project planning	Idea generation and entrepreneurship decision
Carrying out an entrepreneurship project	IT infrastructure Databases and information systems E-commerce	Startup

Governing an entrepreneurship project	Enterprise systems Business intelligence Knowledge management	Entrepreneurial business management
	Business intelligence	
	Knowledge management	

This course is for final-year students. Several of them are currently working for SMEs or their family businesses; some students (mostly major in Entrepreneurship) intend to create an enterprise. Each team of three or four students has to identify a digital entrepreneurship project that could be a new enterprise creation or a digital transformation of an existing enterprise. The key artifacts are the project plan, the e-commerce website and the enterprise systems that are built based on open-source systems and models. At the end of the course, each team presents its projects and key digital artifacts as in a pitch competition. Students also gave their feedback about the different applications and services of the digital infrastructure that simulates the Living Lab such as information awareness, e-collaboration system, business plan building, project management systems, e-commerce web site building, enterprise systems and business intelligence and so on.

Learning

As mentioned in the research question section, after conducting a group discussion with four-year and five-year entrepreneurs, we derive a *three-step digital entrepreneurship roadmap* from the perspective of providing support services for the digital entrepreneurship process, including Idea generation and entrepreneurship decision, Start-up and Entrepreneurial business management. Hereafter some interview results, which correspond to each of three steps.

Idea Generation and Entrepreneurship Decision

Idea generation: Entrepreneurs must always focus on questions about the available products or services and how to generate income and offset costs. These questions allow them to identify the opportunities to meet the market demand. As more and more products and services are offered to the market, finding a place in the market is not always easy. Entrepreneurs should know how to use ICT tools and applications to find the right information and analyse the market to find the suitable success possibility.

Entrepreneurship decision: At this stage, entrepreneurs may form a variety of business ideas. However, to start a business, many of them give up their intention because of their hesitation and failure fear. For someone who just wants to make money fast, starting a business is not the right decision. Nevertheless, for someone who wants to see their ideas work, wants to create a "game" with their own principles and wants economic benefits slowly; they can prepare and decide to start a business.

Start-up

Business planning and product and service testing: During this stage, the person who wants to start the business plan, which is often a short but detailed plan and thus implements the plan. The first implementation process is called the test. Therefore, the business size is very small for the actual market. Those who are interested in the specific product/service can find the right customers. However, what happens in practice may be more or less different from the original estimation.

Building founding team: The people who want to start a business can be the only founders, but it is better to find someone to take jointly this responsibility. The entrepreneurship process is an arduous and challenging process in all aspects, namely: Finance, ideas, operations, health, morale...So, the person who wants to start a business will feel "less exhausted" if he or she finds the cofounder. In addition, it is important to concentrate on the criteria for choosing cofounders. At least, they should have to a shared vision, the principles of value, ethics and similar insights.

Entrepreneurial financing: The resources and resource supply is vital to create at least one path for the entrepreneurship. Each entrepreneur has a different choice of "pouring capital". The entrepreneurs can invest 100% of their own money or call for additional capital from investors or other investment institutions. Any form of capital investment has the strengths and constraints. In general, the entrepreneur is the key decision-maker and is responsible for her or his decisions of entrepreneurial financing.

Business and intellectual property registration: Business registration can take a very short time, within 3-7 business days. However, intellectual property registration can take from 10 to 15 months (until getting the intellectual property certificate).

Entrepreneurial Business Management

Product and service launching and public communication: In this step, the start-up's product and service are officially introduced to the market. The start-ups have to improve their product and service right after the "launch" to suit the actual requirements.

Product and service development, management and control: There are three main factors that entrepreneurs should always concern, including sales revenue, customer data and online user accounts.

FORMALIZATION OF LEARNING

Following the research process, this stage of ADR project develops the situated learning into more general solution concepts for a class of field problems (Sein et al., 2011). The section continues with the generalized outcomes of the PDEP-LL project:

Stakeholders

On the basis of the Living Lab model proposed by Stahlbrost and Holst (2012), we specify the Living Lab model for promoting the digital entrepreneurship process, including the following specific stakeholders: (1) Startups; (2) support service providers; (3) customers (the users of the startups' the product and service); and (4) researchers and students in universities.

Living Lab model for promoting the entrepreneurship roadmap

Living Lab success is the good beginning of the entrepreneurship process. This enables the project creation that can connect the investors for the user adoption and product development (Katzy, 2012).

After discussing with start-up entrepreneurs, we complete the three-step Living Lab

roadmap for the digital entrepreneurship as presented in Figure 3. A detailed architecture of the PDEP-LL includes four layers: Data Services, Knowledge and Information Services and Business Services (Le Dinh, Phan, Bui & Vu, 2016). *Data layer* includes data services that work directly with diverse data sources. *Knowledge and information layer* contains information services that carry out isolated business functions and knowledge services support entrepreneurship process. *Business layer* includes the process representation and provides the structure for aggregating knowledge services to form a knowledge-intensive entrepreneurship process that will be aligned with business objectives of each step.

Step 1: Idea generation and entrepreneurship decision

This is the first and the most important step. As mentioned above, at this step, the entrepreneur comes up with different ideas and asks many questions in order to find the most feasible and beneficial ideas. All decisions must be carefully considered based on what the consumer feels about the product and service. That is why researchers in the Living Lab assist entrepreneurs in connecting them with consumers through the information awareness tool as a *scanning tool*. This tool allows the entrepreneurs to get accurate information about what the consumers think about their products and services provided. In addition, scanning tools allow the researchers to understand consumers' the product and service satisfaction.

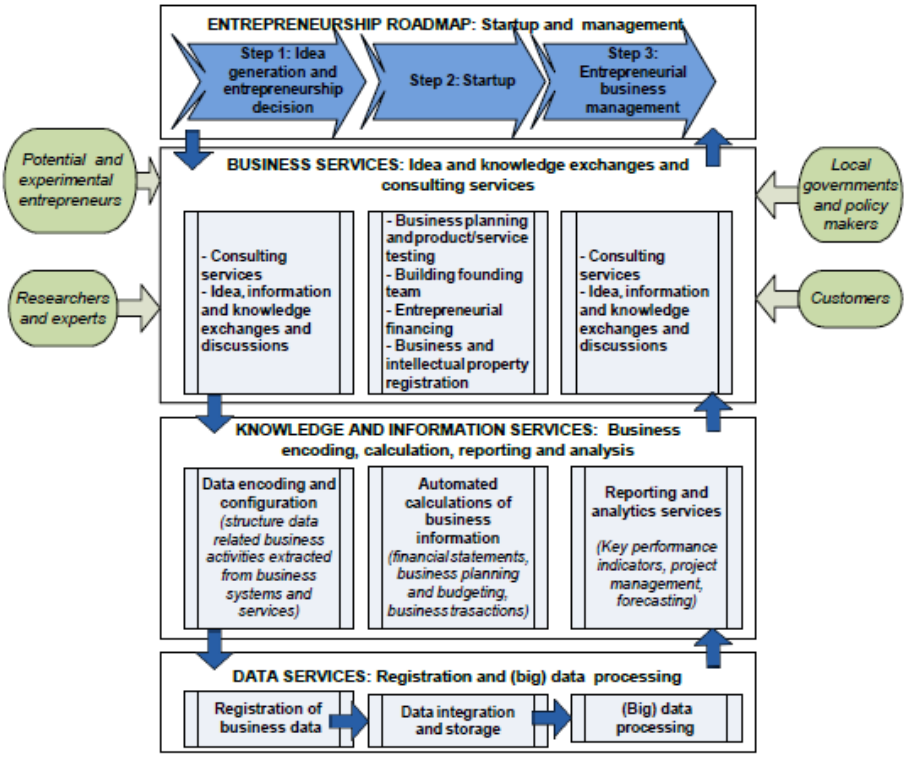

FIGURE 3
LIVING LAB AS A DIGITAL INFRASTRUCTURE FOR DIGITAL ENTREPRENEURSHIP

In addition, the entrepreneurs should always consider other determinants of the business environment by analysing the market where they want to start a business. Therefore, the entrepreneurs should know if their business idea is feasible. In addition, the entrepreneurs should interact with the researchers for collecting this information; hence, they can choose their ideas and make the decision to start a business.

Step 2: Start-up

As discussed above, at this step, the entrepreneurs perform the main activities of business planning; product and service testing; cofounder finding; capital investment attraction and trademark registration.

After choosing the right business idea, the entrepreneurs develop their business plan through the support service providers. This activity allows the entrepreneurs to identify advantages and disadvantages. In general, business planning is very important; so, the entrepreneurs should receive the support from professional service providers.

Through the Living Lab and the user-centred principle, the entrepreneur performs the first trial of the product and service, thereby improving the product and service by recognizing the user's assessments. To test the product and service in the most realistic environment, the researchers play the major role of providing the technologies and services for building the Living Lab that contributes to the start-ups' business planning, product and service testing as well as collaborative workspace supporting.

In addition, the Living Lab introduces the products and services to the individuals seeking collaborative opportunities. The researchers provide the advice of capital investment to start-ups. Thanks to the Living Lab, the entrepreneurs can negotiate and seek funding opportunities. It can be said that the Living Lab provides an environment not only for users, but also for partners to exchange ideas on products/services and sponsorship opportunities. Researchers, students, support providers and users who participate in product and service testing can become potential project partners. In addition to the main information about the products and services, the information about the market, business plan and the entrepreneur is also provided. This allows the participants to understand the entrepreneurship project and to make the right investment decisions.

Through the Living Lab, financial investors and bank credit officers have the opportunity to access start up projects, thereby evaluating and funding the project. Legal entities are also able to provide the services of business registration, trademark registration, patent and invention rights, etc. for the start-ups.

Step 3: Entrepreneurial business management

At this step, the start-ups' products and service are officially introduced to the market thanks to support service providers. The start-ups should pay close attention to their sales revenue, customer data and online user accounts for updating their business situation. The Living Lab community now supports the start-ups in tracking this information, thereby developing the products and services to suit the actual situation. This is the formal step of start-ups; therefore, it requires that the start-ups must have the business management skills. The Living Lab community supports the start-ups in managing and controlling business activities through professional support software or services from specialized organizations or experts from universities.

The opportunities and risks for the start-ups increase during this step compared to the previous steps. The start-ups gradually promote their product and service development by

themselves or by interacting with professional support service providers.

CONCLUSION

In this paper, we explored the newly arising topic of the digital entrepreneurship in detail and proposed a framework for elaborating a Living Lab for promoting the digital entrepreneurship process, called PDEP-LL (Promoting Digital Entrepreneurship Process Living Lab). The PDEP-LL aims at accompanying entrepreneurs and SME managers throughout the digital entrepreneurship roadmap that includes three entrepreneurship steps (Idea generation and entrepreneurship decision, start up and entrepreneurial business management). More precisely, this paper sheds light on the entrepreneurship process in the digital ecosystem in the university environment, thereby expanding our understanding of this application in different aspects of the digital economy. Consequently, these implications suggest that a Living Lab as a digital infrastructure can be efficient not only for students but also for entrepreneurs and SME managers.

Inspite of the research results, our paper has some limits. The framework for PDEP-LL is proposed on the basis of a theoretical framework, the consultation with start-up entrepreneurs and the experimentation with students; it has not yet been empirically verified thoroughly in the real-world context. Furthermore, we have still not yet exploited technically in detail all the knowledge and information services and partially the data services. These limits consist in also our research perspectives in the near future. Although this paper (like every other study) is subject to limitations, it presents possibilities for future research. The small number of participants and the university context provide a restricted view of the digital entrepreneurship process. Additionally, the topics presented in the expanded framework may not be transferable or applicable to all business schools.

Future research could be an action research approach, to obtain the evidence of the feasibility of the Living Lab approach by experiment the PDEP-LL with selected local entrepreneurs. Furthermore, a future empirical research design would allow for more generalizable findings and conclusions. An examination of the study's limitations could have a positive influence on the design of future studies. The link between the Living Lab approach and the field of entrepreneurship clearly needs more attention and development in order to understand better the various options in this area. In addition, a closer examination of the information system management appears to be promising. Therefore, such research could contribute to the further development of our framework and to a deeper understanding of the LDEP-LL and its potential applications. Finally, future research should also include big data exploration in the LDEP-LL in order to accompany the learning process of each entrepreneur based on his profile and the maturity of his enterprise.

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