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Collaborative Networking to Enable Innovation and Entrepreneurship Through Open Innovation Hubs: The Entrepreneurship Learning Centre of Mexico City

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Abstract. Collaborative Networks have shown to have a high potential as drivers of value creation; therefore, it is increasingly frequent to observe how organisations and governments are implementing collaborative networking to support their innovation processes and foster entrepreneurship in benefit to society. Consequently, it is observed that these implementations can contribute to accelerating the development of weaker local and regional economies, especially in developing countries. In this paper, it is presented the Open Innovation Hub of México City of the *ECOS Network* and how by applying collaborative networking, it is possible to foster both innovation and entrepreneurship. Also, the Learning Centre for Entrepreneurship in Mexico City as part of this Hub is described. Finally, a case study with an imparted teaching-learning program is presented. And so, there are described how by using the concepts of Open Innovation and Education 4.0 are designed and implemented specific teaching-learning programs to encourage the creation of new enterprises.

Keywords: Collaborative Networks · Open Innovation · Entrepreneurship · Higher Education · Educational Innovation · Education 4.0

1 Introduction

In recent years, the economies of many countries have lost dynamism and have been lower than official estimates, especially for developing countries [1], [2], [3]. Consequently, many efforts and strategies have emerged to contribute to economic growth. In this context, innovation and entrepreneurship have been found to be excellent engines to achieve economic growth since these activities stimulate regional economies by strengthening the economy and creating jobs [4]. As part of these activities, the design and development of technology-based solutions have shown to have a more significant effect not only to the economic growth of developing countries but also to overcome the gap with technologically advanced countries [5]. Therefore, today developing countries are promoting the development of technology-based products/services and stimulating technology transfer to activate regional economies [6].

In the case of the Greater Mexico City, the biggest in Mexico, this situation is challenging since it is one of the largest metropolitan areas in the world with a population of more than 21 million people [7]. Therefore, the social challenges in this region are enormous. In this sense, in recent years, this region has faced a large scale of social problems such as unemployment, pollution, delinquency, complex mobility, lack of sufficient water supply, and also it is very susceptible to natural disasters such as major earthquakes and sanitary contingencies that origin greater negative effects. This situation provokes severe economic disequilibrium that affects especially vulnerable sectors of society and micro, small and medium-sized enterprises. For these reasons, it is necessary the creation of initiatives that can act and respond in a quick way to these problems. Therefore, it is required to implement strategies that can satisfy the needed demand of the region. As a result, it is needed to build innovation ecosystems as a common link between different organisations to participate in the creation of Collaborative Networks (CNs) to achieve right solutions, since it has been observed that organisations that work independently do not have enough capacities and capabilities to meet the demand that this region requires and current similar systems are not fully effective [8].

In this paper, a strategy to face these issues through the creation of an Open Innovation Hub is presented. Hence, this work presents the five created entities that make up this Hub, (i) The observatory of technology, innovation and development, (ii) The entrepreneurship learning centre, (iii) The intellectual property strategy centre, (iv) The technology transfer and escalation office and the supports for (iv) developing technological road maps and (v) Mentoring from technological experts. The main purpose of this work is to provide an operating reference that can be used and replicated by other regions, especially for cities that have a high concentration of population. Finally, in this paper is presented the Entrepreneurship Learning Centre of Mexico City in order to show how CNs are built to operate this centre and how is carry out a learning-teaching program with the citizen of Mexico City and a Bootcamp for the creation of Sensing, Smart and Sustainable enterprises is presented as a case study.

2 Collaborative Networks and Open Innovation

Today, many organisations of different sectors are adopting strategies and best practices which are based on collaborative and cooperative processes. Then, these organisations are considering the participation of different actors from different sectors and expertise areas to improve their ability to innovate and manage the processes of value co-creation [9]. Therefore, different methodologies, frameworks and concepts have emerged to articulate and manage these activities such as Collaborative Network Organisation (CNO) frameworks and the concept of Open Innovation.

A CNO or simply known as Collaborative Network (CN) is a network that consists of a variety of entities (e.g. organisations, enterprises, universities, people, among others) that are largely autonomous, geographically distributed, and heterogeneous in their operating environment, culture, social capital and goals that have come together to collaborate in order to better achieve common or compatible goals, and whose interactions can be supported by computer networks' [10], [11]. In this sense, it has

been observed that CNs have been shown a high potential not only as drivers of value co-creation but also as drivers to share knowledge, resources, joining complementary skills and capacities and even risks, which allow them to strengthen their processes and make the most of resources [9], [12]. Also, it has been demonstrated that CNs induce the implementation of Open Innovation processes since it allows the confrontation of internal and external ideas and practices, the combination of resources and technologies and the creation of synergies between different multidisciplinary actors.

On the other hand, Open Innovation is generally seen as a key collaborative strategy. Therefore, organisations are taking advantages of these joint projects to evolve and face in a right way current challenges through the co-development of innovative and disruptive processes, services and products which currently are mainly based on technological solutions (including connectivity, digitalisation, and virtuality). This concept was introduced by H. Chesbrough, and it refers that “Open innovation assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market (...). Valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well” [13]. The keys to open innovation paradigm are openness, collaboration and the search for creativity. Therefore, many organisations have been adopted this way to operate during innovation processes, and they include the participation of not only of internal actors but also the participation of external actors to improve the competitive possibilities of the organisation. In this paper, both terms CNs and Open Innovation are implemented as the main strategy to operate and manage an Open Innovation Hub in Mexico City.

3 The Open Innovation Hub of Mexico City

According to the literature, Innovation Hubs envision a centre of exchange that builds on the foundation of creativity and innovation to create not only new high value-added products (and services), and business/processes that will aid the creation of new business models and enterprises “startups” but also to provide quick solutions to current social problems [8]. In this sense, many Innovation Hubs have been emerged to promote knowledge-sharing and collaborative and cooperative processes to encourage co-designing and co-development of technology-based solutions. Therefore, Innovation Hubs are committed to ensuring the development and implementation of the best technological solutions by taking advantages of diverse resources coming from different places.

More recently, the term Digital Innovation Hubs has been emerged to support companies through the use of information and communication technologies (ICTs) [14]. Hence, these Hubs are not only adopting ICTs, but also they are utilising best practices and activities such as platforms for collaborative networking and services (e.g. online file storage services, communication web-based systems, social networking, and other robust platforms such as enterprise software and PLM systems). Then, nowadays, these terms can be indistinctly used since both of them are powered by the Internet of Things (IoT) and current ICTs.

In this paper, it is presented the Open Innovation Hub of Mexico City. This Hub was created in 2019 as part of the CN called “*Red ECOS*”, which is in charge of

coordinating, managing, and funding its sub-networks (e.g. electromobility network, earthquake network, bioenergy network, among others) within the Government Program 2019-2024 of the Secretary of Education, Science, and Technology of the Government of Mexico City. The Hub is related to the concept of “strengthening the social economy and entrepreneurship”; likewise, it proposes to coordinate actions to promote the constitution and strengthening of the social and solidarity economy sector. This Hub consists in the participation of different actors to support these initiatives and in this way, promote the co-design and co-development of technology-based solutions that can address current priorities and problems in the region. Therefore, the main objective of this Open Innovation Hub is to foster and strengthen the scientific, technological and digital infrastructure by generating physical and virtual innovation ecosystems that can link and articulate the participation of diverse actors from different sectors both internal (government) and external (e.g. academic, scientific, industrial, entrepreneurs, society and other government areas) to generate joint-projects with the primary purpose of contributing with positive effects to the regional economic development and the social welfare of citizens. In specific, this Hub will support technology-based product development and enterprise creation.

The main defined activities to be performed in this Hub are listed below: (i) Provide right tools and strategic information, (ii) Provide a diagnosis of priorities/problems to be focused, (iii) Provide teaching-learning programs for human resources training, (iv) Provide support for technological solutions by technological experts, (v) Provide support for defining intellectual property strategies and for intellectual property processes and management, and (vi) Provide support for defining best strategies for technology transfer including knowledge transfer, funding, licensing, and project management. Consequently, this Hub will operate by linking actors from different sectors, and there were created different entities as part of this Open Innovation Hub. Figure 1 shows the defined strategies that pursue this Hub, the integrated CN and the created entities.

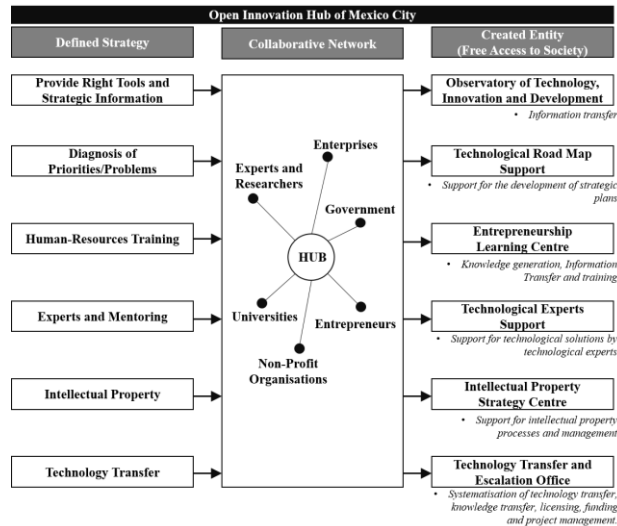


Fig. 1. The Open Innovation Hub of Mexico City – Main Model

4 The Entrepreneurship Learning Centre of Mexico City

Currently, the role of universities in the entrepreneurship context goes far beyond the knowledge-generation/information-transfer to participating in business ecosystems, partnerships and industrial alliances. Therefore, today, it is considered that universities are excellent drivers to achieve innovation and foster entrepreneurship through the implementation of new teaching-learning programs.

In this sense, the term *Education 4.0* has been used to describe how today's teaching-learning programs are being designed and taking advantages of current ICTs and physical infrastructure/facilities. Education 4.0 comes from the well-known concept of *Industry 4.0*, which refers to technological evolution according to the periods of four industrial revolutions that have been experienced in humanity [15]. Therefore, in the case of the education sector, the improvements of pedagogical processes and their relationship with the technological evolution are known today as Education 4.0. In this sense, new learning methods (i.e. problem-based learning (PBL), learning by doing (LBD), challenge-based learning (CBL), among others) and practices that use efficiently new infrastructures/facilities (i.e. collaborative and co-working spaces, maker spaces, specialised labs, among others...), tools and ICTs (i.e. virtual classrooms, Learning Management Systems (LMS), Massive Open Online Courses (MOOCs), AR and VR platforms, among others..) have emerged and considered as part of the design of new teaching-learning programs that will allow participants/students/entrepreneurs acquire and train desirable competencies both soft and hard competencies in this area.

Therefore, the Tecnológico de Monterrey, University in Mexico is participating in the design and operation of the proposed Entrepreneurship Learning Centre of the Open Innovation Hub. The main objective of this learning centre is to establish an entrepreneurial culture, the training of society, and the support for the development of new products (and services), new business/processes and the creation of new enterprises (startups and spin-offs) through the implementation of teaching-learning programs. The proposed programs are designed considering the four key components of Education 4.0, (i) training and developing desirable competencies in today's students/entrepreneurs, (ii) incorporation of new learning methods, (iii) implementation of current and emerging ICTs, and (iv) use of innovative infrastructure to improve learning processes. As a result, four different programs are proposed to start with the operation of this learning centre, (i) MOOCs, (ii) Face-to-Face Courses and Hybrid Learning Programs, (iii) Personalised Mentoring, and (iv) Talks-Networking with Experts. These programs are aligned to specifically promote three types of entrepreneurship, (i) Social Entrepreneurship, (ii) Technological Entrepreneurship and (iii) Scientific Entrepreneurship. See Figure 2.

Figure 3 shows the generic teaching-learning model used in the design of the proposed programs. This model illustrates what are the main inputs and outputs that were considered in the proposed teaching-learning programs. Also, there are illustrated how these processes will be performed (mechanisms) and the participating actors that will be controlling the processes.

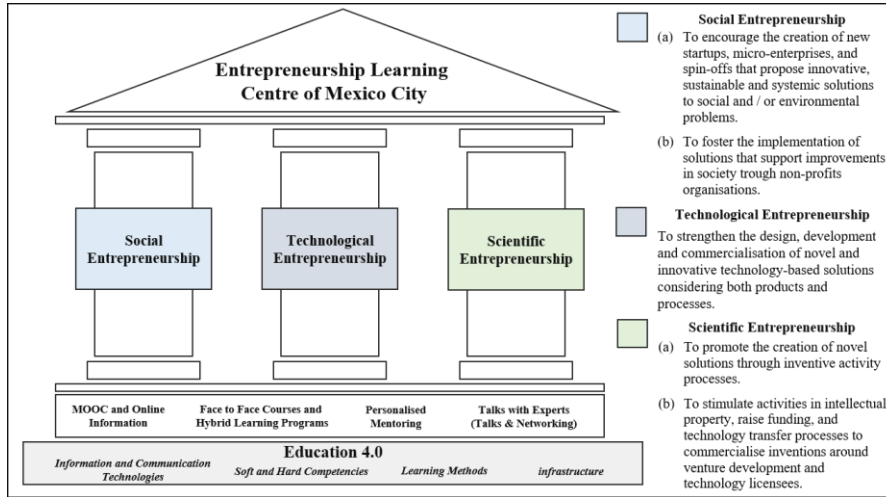


Fig. 2. The Entrepreneurship Learning Centre of Mexico City – Model

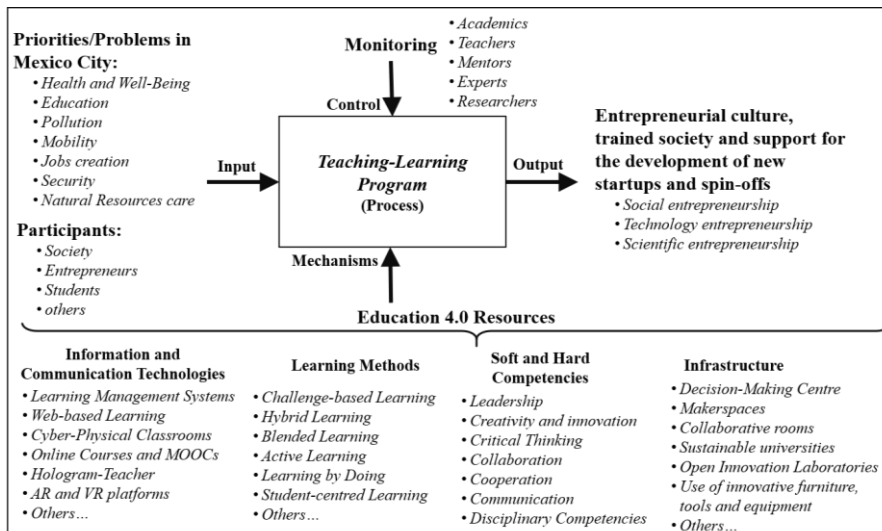


Fig. 3. Proposed Teaching-Learning Model to foster the entrepreneurial culture

5 Case Study: The Sensing, Smart and Sustainable Enterprise Creation Bootcamp – Learning-Teaching Program

In order to show how the proposed Entrepreneurship Learning Centre works, in this section is presented the Sensing, Smart and Sustainable (S³) Enterprise Creation program that is a designed intensive teaching-learning program in the modality of a bootcamp. The design of this bootcamp also is based on the concepts of CNs and Open Innovation since it adopts active learning dynamics in which the participation of

different actors is required. The primary purpose of this teaching-learning program is that participants can learn main processes that are carried out during innovation and entrepreneurship processes by doing specific activities and using specific tools. Therefore, this teaching-learning program was designed under two main frameworks, Education 4.0 and S³ Enterprise [16], [17].

The framework of S³ Enterprise tries to encourage entrepreneurs to create highly competitive enterprises through the incorporation of the sensing [18], smart [19], [20], and sustainable [21] characteristics during the enterprise creation process. The main objective of this new generation of enterprises is that they can be able to satisfactorily respond to market uncertainties, improve their processes and optimise the use of their resources. Therefore, new enterprises must adopt new strategies, practices and technologies that allow them to be competitive in the market and respond adequately to customers' demand [22].

To apply these three characteristics, it is necessary to take advantage of both current and emerging technologies (IoT, artificial intelligence, sensing technologies, big data, among others), and collaborative strategies.

Figure 4 shows the designed teaching-learning program called *The Sensing, Smart and Sustainable Enterprise Creation - Bootcamp*. This bootcamp is composed of five modules (i) Conceptualisation, (ii) Value Proposition, (iii) Structuring, (iv) Business model, and (v) Infrastructure that are reviewed over 10 sessions (40 h.). The modules are taught by using new learning methods in face-to-face and virtual modality. Also, this bootcamp considers mentoring, such as key activity since each project has different purposes and creation processes. Then participants can interact with different experts in order to accompany the participants during the enterprise creation process; thus, new enterprises, spin-offs and non-profit organisation can emerge. Table 1 presents a summary of the taught bootcamp and Table 2 presents a summary of the obtained results by each of the six projects developed during this bootcamp.

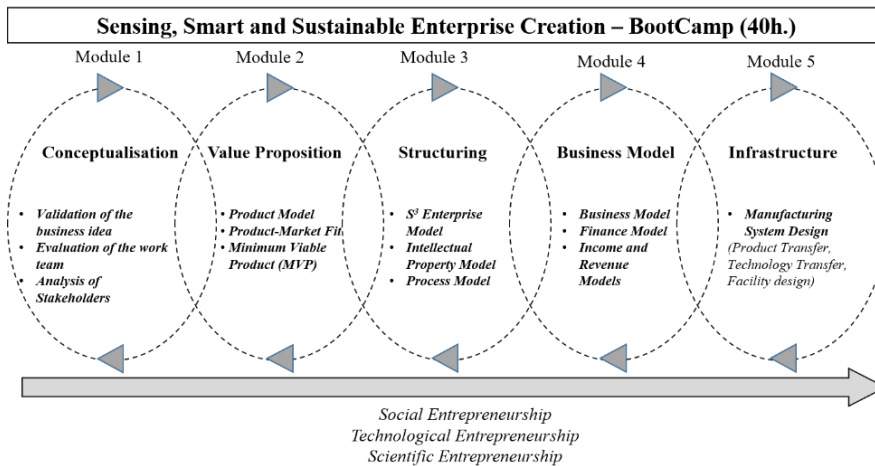


Fig. 4. Designed Teaching-Learning Program – The Sensing, Smart and Sustainable Enterprise Creation in the Bootcamp modality

Table 1. Summarised results of the performed S³ Enterprise Creation Bootcamp

Alternative Credential: S³ Enterprise Creation Bootcamp, Hybrid Learning (Face-to-Face and Virtual Modality).
Duration: 10 sessions, 40 hours.
Participant Profile: Junior Entrepreneurs and participants from startups and non-profit organisations
Number of Participants: 20 (6 projects).

Input	Process	Output
1. Conceptualisation Conceptualise a new business idea providing technology-based solutions aligned to the current priorities/problems of Mexico City.	Main Learning Method: <i>Problem-based learning and Active Learning</i> Main Competencies: <i>Soft: Critical Thinking, Creativity and Innovation, Hard: Promote the development of technology-based enterprises/spin-offs</i> Main Infrastructure: <i>Designing rooms and Gesell chamber</i> Main ICT: <i>MOOC and Mobile APP [17]</i>	<ul style="list-style-type: none"> • Validation of the business idea • Definition of new business models/processes • Identification of new products (and services) • Creation of new enterprises (startups or spin-offs)
2. Value Proposition Define and validate the value proposition of the product/service/business that will be provided by the conceptualised enterprise.	Main Learning Method: <i>Blended-based Learning and Learning by Doing</i> Main Competencies: <i>Soft: Collaboration and Cooperation, Hard: Use of Collaborative Virtual Platforms</i> Main Infrastructure: <i>Designing rooms, Makerspaces and the Decision-Making Centre</i> Main ICT: <i>MOOC and Online Materials</i>	<ul style="list-style-type: none"> • Understanding of the Product, Customer, Sales model • Validation of the Product-Market
3. Structuring State the structure of the defined enterprise considering, purposes, functionalities, processes, and legal aspects.	Main Learning Method: <i>Active Learning and Hybrid Learning</i> Main Competencies: <i>Soft: Collaboration, Cooperation and Communication, Hard: Virtual and Digital infrastructure</i> Main Infrastructure: <i>Virtual Classroom, Computational Labs</i> Main ICT: <i>MOOC and Online Materials</i>	<ul style="list-style-type: none"> • Definition of the sensing, smart and sustainable model • Definition of the processes to be performed • Identification of the Intellectual Property strategy
4. Business Model Refine the business idea and build a robust business model.	Main Learning Method: <i>Challenge-based learning and Blended Learning</i> Main Competencies: <i>Soft: Collaboration and Cooperation, Hard: Use of digital platforms</i> Main Infrastructure: <i>Virtual Classroom and LMS</i> Main ICT: <i>MOOC, LMS and Online materials</i>	<ul style="list-style-type: none"> • Validation of the Finance, Income and Revenue models • Refinement of the Business Model
5. Infrastructure Define the needed infrastructure or manufacturing system to be implemented.	Main Learning Method: <i>Challenge-based learning and Active Learning</i> Main Competencies: <i>Soft: Critical Thinking and Communication, Hard: Definition of Virtual and Digital infrastructure</i> *Main Infrastructure: <i>Virtual classroom and Decision-Making Centre</i> Main ICT: <i>MOOC, LMS, and Online materials</i>	<ul style="list-style-type: none"> • Definition of the manufacturing system design (product transfer, technology transfer or facility design) strategies • Enterprise Pitch

Table 2. Summary of the obtained results by the participants

Input	Particular Process	Improved Value
Project 1: Startup in the area of collection and recycling of vegetable oil, and creation of biofuel	Spin-Off strategy process and New Product Development	<ul style="list-style-type: none"> • Incorporation of new products/services • Definition of its business model • Intellectual property strategy
Project 2: Startup in the area of digital platforms for education	Spin-Off strategy process	<ul style="list-style-type: none"> • Incorporation of new products • Definition of a product portfolio • Redefinition of its business model
Project 3: Startup in the area of communication and streaming services	Enterprise creation	<ul style="list-style-type: none"> • Definition of a product-service system • Definition of a product/service portfolio • Definition of a business model
Project 4: Startup in the area of waste management and recycling	Spin-Off strategy process	<ul style="list-style-type: none"> • Development of a minimum viable product • Definition of a shared value strategy • Redefinition of its business model
Project 5: Startup in the area of e-commerce by promoting the exchange of goods and services	Spin-Off strategy process	<ul style="list-style-type: none"> • Definition of a shared value strategy • Definition of its business model
Project 6: Non-Profit Organisation that support the supply chain process to small producers in the agroindustry sector	Sustainable organisation model and validation of technologies	<ul style="list-style-type: none"> • Definition of a sustainable organisation strategy • Intellectual property strategy

6 Conclusion and Future Work

Dynamic in big cities are complex since it demands the right solutions for many social problems. Therefore, the collaborative and cooperative participation of different actors has shown to be an effective strategy for joint efforts and share resources and responsibilities. In this sense, it can be proved that by applying concepts such as CN and Open Innovation can be structured new initiatives that involve the participation of different actors, both internal and external. Then, innovation processes, development times, communication channels and optimisation of the use of resources are improved.

In the context of innovation and entrepreneurship, it was observed that creating adequate ecosystems such as Innovation Hubs was useful to articulate initiatives to fostering innovation and entrepreneurship in society and promoting the development of technology-based solutions that can be materialised in new product/services and business models. Then, the creation of new startups and spin-offs is promoted. In this sense, it is noted that higher education has had an important role since it is a direct bridge between society-innovation-entrepreneurship. Then, the capacities of universities can be used to train desirable competencies in the profile of current students/professionals/entrepreneurs, both soft and hard.

Future work is related to document an evaluation of the performance of the different created entities of the Hub. Also, currently, it is carried out a bootcamp participants' assessment in order to measure the benefits obtained in the outcomes. Finally, it is in progress the development of an On-Demand virtual platform – MOOC to meet the demand for users that Mexico City requires.

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