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Characterization and Analysis of Business Incubation Systems in Costa Rica: The Case of Public Universities

CARACTERIZACIÓN Y ANÁLISIS DE LOS SISTEMAS DE INCUBACIÓN DE NEGOCIOS EN COSTA RICA: EL CASO DE LAS UNIVERSIDADES PÚBLICAS

RESUMEN: A pesar de la inexistencia (o dispersión) de datos e información pertinente, este trabajo, realizado en el 2015, describe las características de un modelo de negocio de incubación que propone una visión integral para el caso de Costa Rica. Este estudio, de corte exploratorio, utiliza técnicas típicas de recopilación de información desde un paradigma cualitativo con elementos etnográficos. Por ende, se llevaron a cabo entrevistas en profundidad con los gerentes de incubadoras de empresas vinculadas a proyectos activos en universidades públicas de Costa Rica. Adicionalmente, se aplicó un cuestionario digital a los gerentes de incubadoras en América Latina (Chile y México), con el fin de comparar aspectos relevantes entre ellas. Como resultado, se determinaron 81 características en un modelo de ocho categorías: aspectos constitutivos, perfil directivo, modelo organizacional, estrategias de gestión, recursos operativos, alianzas estratégicas, gestión de proyectos y relación con los estudiantes. Aunque existen elementos comunes en todas las incubadoras, fue posible determinar que cada modelo tiene una identidad propia, con múltiples características distintivas, tales como modelo organizacional, modelo académico, recursos disponibles y procesos de estandarización para potenciales emprendedores.

PALABRAS CLAVE: Incubación de empresas, modelos de incubación, emprendimiento académico, gestión universitaria, desarrollo empresarial.

CARACTERIZAÇÃO E ANÁLISE DOS SISTEMAS DE INCUBAÇÃO DE NEGÓCIOS NA COSTA RICA: O CASO DAS UNIVERSIDADES PÚBLICAS

RESUMO: apesar da inexistência (ou dispersão) de dados e informações pertinentes, este trabalho, realizado em 2015, descreve as características de um modelo de negócio de incubação que propõe uma visão integral desse ecossistema na Costa Rica. Este estudo, de tipo exploratório, utiliza técnicas típicas de recopilación de informação a partir de um paradigma qualitativo com elementos etnográficos. Nesse sentido, foram realizadas entrevistas em profundidade com os gerentes de incubadoras de empresas vinculadas a projetos ativos em universidades públicas da Costa Rica. Além disso, foi aplicado um questionário digital aos gerentes de incubadoras na América Latina (Chile e México) a fim de comparar aspectos relevantes entre elas. Como resultado, foram determinadas 81 características em um modelo de oito categorias: aspectos constitutivos, perfil diretivo, modelo organizacional, estratégias de gestão, recursos operativos, parcerias estratégicas, gestão de projetos e relação com os estudantes. Embora existam elementos comuns em todas as incubadoras, foi possível determinar que cada modelo tem uma identidade própria, com múltiplas características, como: modelo organizacional, modelo acadêmico, recursos disponíveis e processos de padronização para potenciais empreendedores.

PALAVRAS-CHAVE: desenvolvimento empresarial, empreendedorismo acadêmico, gestão universitária, incubação de empresas, modelos de incubação.

CARACTÉRISATION ET ANALYSE DES SYSTÈMES D'INCUBATION D'ENTREPRISES AU COSTA RICA : LE CAS DES UNIVERSITÉS PUBLIQUES

RÉSUMÉ: Malgré l'absence (ou la dispersion) de données et d'informations pertinentes, ce travail, réalisé en 2015, décrit les caractéristiques d'un modèle d'entreprise d'incubation proposant une vision intégrale dudit écosystème au Costa Rica. Cette étude exploratoire utilise des techniques typiques pour la collecte d'informations à partir d'un paradigme qualitatif avec des éléments ethnographiques. Des entretiens approfondis ont donc été menés avec les responsables d'incubateurs d'entreprises liées à des projets en cours dans des universités publiques au Costa Rica. En outre, on a appliqué un questionnaire numérique aux gestionnaires d'incubateurs d'Amérique latine (Chili et Mexique) afin de comparer les aspects pertinents entre eux. Ainsi, on a déterminé 81 caractéristiques dans un modèle en huit catégories : aspects constitutifs, profil managérial, modèle organisationnel, stratégies de gestion, ressources opérationnelles, alliances stratégiques, gestion de projet et relations avec les étudiants. Bien qu'il y ait des éléments communs dans tous les incubateurs, il a été possible de déterminer que chaque modèle a sa propre identité, avec de nombreuses caractéristiques distinctives, telles que modèle d'organisation, modèle académique, ressources disponibles et processus de normalisation pour les entrepreneurs potentiels.

MOTS-CLÉ: Incubation d'entreprises, modèles d'incubation, entrepreneuriat universitaire, gestion d'université, développement commercial.

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ABSTRACT: Despite the inexistence (or disintegration) of data and pertinent information this study, conducted in 2015, describes the characteristics of an incubation business model that proposes an integral vision of this ecosystem in Costa Rica. This exploratory study uses typical information collection techniques for the application of a qualitative paradigm with ethnographic elements. In-depth interviews were carried out with business incubator managers holding active projects at public universities in Costa Rica, and a digital questionnaire was sent to incubators managers in Latin American (Chile and Mexico) to compare relevant aspects between incubators. As a result, 81 characteristics were determined and grouped in a model of eight categories: constituent aspects, directive profile, organizational model, management strategies, operational resources, strategic alliances, project management, and student relationship. Even though common elements are present in incubators, it was also determined that each model has its own identity with multiple distinctive characteristics, such as: an organizational model, an academic model, available resources and standardization processes for potential entrepreneurs.

KEYWORDS: Business incubation, incubation models, academic entrepreneurship, university management, business development.

Introduction

A transformation from a traditional university "focused on the academical aspects to one that integrates the economic life of the regions" (Valera, 2005, own translation) becomes necessary. This change provides the information that society requires through useful researches in order to increase the innovative capacity of the economy (Lebendiker, Herrera, & Velásquez, 2014) and favor economic rentability (Brunner & Miranda, 2016; Coyle, Gibb, & Haskins, 2017; Rodeiro, 2007) by promoting a higher economic growth in regions (Monge & Torres, 2015; Rodeiro, 2007).

University entrepreneurship promotion through the management of university business incubation has been approached by this study to provide new knowledge about modelling the business system in public higher education in Costa Rica, including details of the incubation systems of each university. Therefore, the objective of this study is to analyze the relevant organizational characteristics of business incubators in public universities in Costa Rica to build a model with the principal elements of the existent business

incubation systems in public universities in the country. The research question allow to find out the elements that compose the studied incubators and how they fit into a model.

Notably, in the moment of this study, no indexed publication describing detailed characteristics of business incubators in public universities in Costa Rica was available. As a result, this research outcome is relevant not only for the primary information provided, but also for the structured analysis presented. Such analysis models the national ecosystem of business incubators in public universities. Besides, it substantially contributes to the theoretical knowledge on this field.

This innovative study allows researchers to extrapolate results from these incubation models used in face-to-face education towards other organizations, including those with distance education systems.

For this study, three topics were studied: (i) the relevant organizational characteristics of business incubators in public universities in the country; (ii) a comparative analysis of the relevant characteristics of these business incubators; and (iii) distinctive organizational characteristics of two business incubators excelled in the international field.

The development of this article is structured as follows. The first section presents a review of the literature on the characteristics of business incubators. Section two refers to an in-depth analysis of literature as a starting point of the analysis dimensions that constitute the construction of the studied model and includes the description of the instruments used to gather the information. Section three explains the main results obtained in this research. Finally, section four shows the relevant conclusions of this work and describes other aspects to consider in future studies.

Theoretical Framework

The theoretical framework was developed around three thematic axes: business incubation, incubators success factors and their impact in society. It also reduces the knowledge gap regarding business incubation insights.

Business Incubation Definition

According to several authors, there is no consensus in the definition of business incubation, thus, a unique definition of this concept is not existent (Cornelius & Bhabra, 2003; Theodorakopoulos, Kakabadse, & McGowan, 2014). Authors like Theodorakopoulos, Kakabadse, and McGowan (2014) provide 12 definitions, while Hackett and Dilts (2004) present 22. The list of references of this document includes different authors who had given multiple definitions on this

phenomenon. Beyond the interest of developing theoretical aspects around incubators, such as definitions, it has been relevant to acknowledge the configuration of incubators through the study of relevant factors.

Authors such as Cornelius and Bhabra (2003) discuss the difficulty for researches to obtain data from the incubators due to the lack of the standardization of the concept itself. In fact, Hackett and Davis (2004) mention an example of this problem with the so-called virtual incubators, whose concept is unclear, since its management can easily be confused with similar services.

From the literature, a business incubator definition can be built using the concepts already given by some recognized authors. A useful definition considering the ideas by many of these authors is the following:

The concept of business incubation is linked to the existence of an organization that gives an especially innovative environmental design through instruments, resources, services and cooperation networks. It organizes and orchestrates the existing forces contemplating market flows to support the generation of new businesses in a way that the systematized process is accelerated for the creation, growth and consolidation of incipient businesses. It takes as starting point the capacities of citizens who work as entrepreneurs with ideas born from varied sources as university experiences can be.

Success Factors in Business Incubators

Different authors have identified the relevant elements for the existence of an incubator (Somsuk & Laosirihongtong, 2014). Peña-Vinces, Brabo, Álvarez, and Pineda (2011) mention seven survival pillars or key criteria for business incubators: management, finance, administrative management, infrastructure, incubation model, networking, incubator performance, and human talent management.

Hackett and Dilts (2004) state that the success of an incubator is mostly related to the presence or absence of coaching and the access to the work network that provides proactive feedback to the incubators. Even though there is a lot of information related to incubators, no consensus in its success factors has been achieved (Theodorakopoulos *et al.*, 2014). Authors like Lee and Osteryoung (2004) have developed studies that compare critical factors of success (CFS) for American and Korean incubators, identifying broad similarities, except clarity and degree of concreteness.

Buys and Mbewana (2007) identified 39 reported factors in literature and consolidated them in 11 constructs as independent variables of analysis: (i) access to science and



technology expertise and facilities, (ii) comprehensive business plan, (iii) stringent selection criteria, (iv) availability of funding, (v) quality of entrepreneurs, (vi) stakeholder support, (vii) supportive government policies, (viii) competent and motivated management, (ix) financial sustainability, (x) experienced advisory board, and (xi) networking.

Wiggins and Gibson (2003) indicate that there are five aspects incubators must do well: (i) establish clear metrics of success, (ii) provide entrepreneurial leadership, (iii) deliver value-added services, (iv) develop new company processes, and (v) give access to human and financial resources.

On the other hand, Hamdani (2006) mentions eleven main characteristics of business incubators: (i) definition and scope, (ii) governance structure of sponsor, (iii) services provided, (iv) sources of funding, (v) incubation period, (vi) entry criteria, (vii) graduation criteria, (viii) objectives, (ix) industry sector, (x) inputs, and (xi) success indicator.

Several authors refer to the success factors, relevant characteristics and best practices (Bergek & Norman, 2008; Lalkaka, 2001) of an incubator, although there is a lack for a standardized vision. Therefore, as part of the research

methodology validation of this article, a chart relating study variables with recognized potential success factors of business incubators is generated.

Incubators Impact

Business incubators, as sources of innovation and technological transfer (Astebro, Bazzasian, & Serguey, 2012), are promoters of economic prosperity (Markman, Phan, Balkin, & Gianodis, 2015) at a national and international level (Carayannis & von Zedwitz, 2005).

Arts, Matthyssens, and Vandenbempt (2007) see incubation as an instrument to promote innovation and reduce the failure of new businesses. As indicated by these authors, the mortality rate of incubated businesses is less than the rate of not incubated new businesses. For that reason, governments have interests in generating a supportive environment for the creation of new companies (Chandra, 2007), followed by entities that provide financial support from banks and private institutions (Aerts, Matthyssens, & Vandebeempt, 2007).

Peña *et al.* (2011) comment on the capacity of incubation models to generate wealth when an initial economic aid is present. These authors also indicate, as a relevant piece of data for the Colombian case, that 22 business incubators linked to the national project SENA provides support to incubators of technological bases "which generated 1,871 jobs and a value in sales of 21,514 million Colombian pesos" (own translation).

At the university sector, the topic of business incubation is well-known for promoting research and development (Barro, 2015; Yasuf & Nabeshima, 2007). However, it is not always implemented due to several reasons, such as the existence of well-timed resources (Maital, Ravid, Ses-hadri, & Dumanis, 2008; Ortin, 2007), wealth availability (Monge, Briones, & Garcia, 2012), variation in incubation programs (Schillaci, Romano, & Longo, 2011), reluctance to new models (Muscio, 2010; Valera, 2005), market and cultural factors linked to the entrepreneur (Maital *et al.*, 2008), among other aspects that generate influence in university-linked incubators (Breznitz & Feldman, 2010). Besides, it is known that the promotion of university policies is not the only necessary measure, but their effective well-timed implementation is also required (Stradi, 2016).

Theory shows that business success probabilities are higher with adequate companionship (Voisey, Gronall, Jones, & Thomas, 2006). As a result, the existence of business incubators is important, and this study contributes as a starting point for the creation of business incubators at universities, both at face-to-face and distance education models.

Closing the Theoretical Gap

After reviewing studies on business incubators in Costa Rica, this study identified that some research has been carried out focusing on how entrepreneurs have developed their businesses. Adding to this topic, this research focuses on identifying incubators success factors and the techniques and procedures required to create new enterprises.

According to Hackett and Dilts (2004), the national research production of knowledge in business incubation can be found in the first two steps presented in figure 1, which presents a range of five research streams developed for the comprehension of the business incubation topic. This figure also shows that the theoretical gap is wider in the lower levels.

Beyond that vision, the generation of new entrepreneurships can be studied from the perspective of an incubator's scope; a subject in which this research intends to generate new knowledge. In this context, the relevance of this study becomes clear, since it pretends to approach innovative,

updated and superior order knowledge (stream E, figure 1) by modeling characteristics, factors, and other elements of the studied ecosystem.

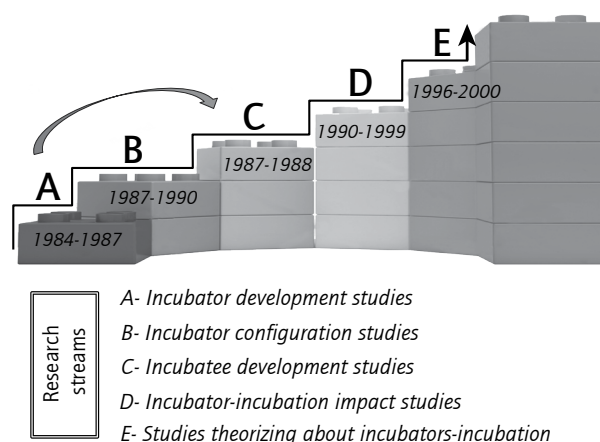


Figure 1. Research lines in business incubation and its relationship with existing literature. Source: Own elaboration with a base of information from Hackett and Dilts, 2004.

Methodology

The paradigm selected for developing this research is qualitative, since this approach allows to visualize how the researcher elaborates categories and arrives to comprehension and interpretations from the data obtained –instead of previous theoretical concepts–, studying the phenomena in a nonlinear process (González, 2003). For the purpose of this study, the researcher collected all the information in 2015.

It is important to point out that since there is no base knowledge formally published on this specific topic, it was necessary to start a qualitative study in order to construct all this information, which did not allow the application of quantitative models at the same time of the study, thus giving a great scientific value to this work.

Specifically, the paradigm of this research has an interpretative character since, as Martínez (2013, p. 5) points out, qualitative studies emerge as an "... alternative to the rationalist paradigm since in social disciplines there are different problematics, issues and restrictions that cannot be explained or understood fully by means of the quantitative methodology" (own translation). In addition, this is an ethnographic study (Hernández-Sampieri, Fernández-Collado, & Baptista-Lucio, 2014), considering it involves an in-depth study on the organizational characteristics of the ecosystem of business incubators. Analysis techniques used are those typically associated to qualitative research, topic analysis and comparative analysis.

To carry out the research, the procedure established by Hernández-Sampieri *et al.* (2014) for the design of a

qualitative research process was carefully followed. The information from all the related chapters were applied to this study and an analysis plan was developed.

The study was conducted according to an analysis plan for the public universities of Costa Rica that have a formally registered business incubator: Technological Institute of Costa (Instituto Tecnológico de Costa Rica, ITCR), University of Costa Rica (Universidad de Costa Rica, UCR) and National University (Universidad Nacional, UNA). The names of incubators were CIE-TEC, AUGÉ and UNA-INCUBA, respectively. In the moment this research was executed, three universities met this requirement (research population), and all of them follow face-to-face teaching models.

The Costa Rican Ministry of Economy, Industry and Commerce (MEIC) published the list of incubators belonging to the National Network of Incubators and Accelerators (RNIA, in Spanish). Besides those belonging to public universities, there are other incubators on the list: Asociación Incubadora Parque Tec, CCC-Franquicia, Parque la Libertad, Carao Ventures S. A., Aceleradora GSI, Pymes de Costa Rica, Instituto de Negocios del Colegio Técnico Profesional de San Carlos, Centro de Emprendimiento e Innovación-UCI, Incubadora de Negocios del Sur, and Incubadora Empresarial de la Región del Caribe (Montes, 2017).

In Costa Rica, private business incubators are related to not only private universities but also private organizations, and they are oriented to be profitable. Private incubators were excluded from this study mainly because the strategic orientations of public universities are completely different from those of private universities or organizations, so the main characteristics of the analysis unit could be considered properly.

The eight dimensions for national incubators have been identified through an exhaustive study of the bibliographical sources by several authors. And they are relevant for the existence and functionality of a business incubator.

Data collection was carried out from primary sources, that is, representatives of 5 business incubators belonging to recognized universities: three previously selected on the national level (Jiménez, Martí, & Vargas, 2015) and two on the international scenario (Latin America).

Instruments for data collection (primary sources) were validated by experts in the fields of entrepreneurship, innovation, and statistics (Stradi, 2016). Pilot interviews served as pre-test for instrument validation and then changes were made. Additionally, in-depth interviews were divided into six topics: organizational model, resources, alliances, projects, students, and recommendations. These interviews included 25 open-ended questions, as well as a guide for the interviewer.

On the other hand, the digital questionnaire contained five topics grouped in 26 questions, which were either closed-ended or semi-open-ended questions (20) and the rest open-ended questions (6). This instrument was sent to the interviewee and returned with the answers via e-mail. Answers were complemented with further questions to sharpen information and then analyzed according to the spiral process of data collection.

Results

The research required a detailed analysis of the information collected. To provide more consistency, reduce bias and increase the comprehension of the object of study (Okuda & Gómez, 2015), an integral analysis of the data collected from both types of sources was carried out. Information was systematized in eight categories of analysis: (i) constituent aspects, (ii) directive profile, (iii) organizational model, (iv) management strategies, (v) operational resources, (vi) strategic alliances, (vii) project management, and (viii) student relationship. Their contents were divided into 81 elements of analysis, which generate an integrated model with the distinctive characteristics of a public university business incubator.

The approach of each dimension is accomplished through a comparative analysis of the information provided by the incubators under study –mainly national incubators– and the study is complemented with the analysis of relevant aspects of the international incubators. Such dimensions are explained afterwards.

Many authors have written about the importance of considering certain elements as critical factors for incubation processes. As a result, a detailed list of this information has been included. For this paper, part of the literature will be related to dimensions analysis and some examples extracted from the fieldwork to illustrate the topic.

Constituent aspects

The oldest incubator is the ITCR incubator, followed by UNA and UCR. There are 18 years between the first and the last. These organizational units emerged as a project, and then they evolved in different ways depending on each university.

In the case of CIE-TEC, this center started as a proposal and then consolidated itself as a project of an academic unit (ITCR). UNA-INCUBA arose as a project (UNA, 2012) attached to the university director office and recently moved to the Office of Knowledge Transfer and External Linkages (OTVE-UNA, in Spanish). AUGÉ Agency started with the support of a twenty-pioneer team that turned into a department currently attached to the Vice-rectory of Research (UCR, 2012; UCR, 2015).

All the incubators assist potential entrepreneurs coming from the universities or from the community. Two incubators (ITCR and UNA) support entrepreneurs who work either individually or in groups while UCR considers only research teams.

It is relevant to point out that the incubators were formally constituted with their respective scope (Carayannis & von Zedwitz, 2005), objectives (Chandra, 2007), goals (Aerts *et al.*, 2007), and policies (Hackett & Dilts, 2004).

Directive Profile

The incubator direction or coordination is assigned to engineering professionals in two of the cases and to a planning professional in the other. In one of the incubators, the person who coordinated the incubator for several years was substituted by a professional with an entrepreneurial profile who holds a licentiate degree and counts on four years of experience (ITCR). In the other two cases, the professionals in charge of the incubator hold at least a master's degree, more than ten years of experience, and training in innovation management.

The incubator ran by the most experienced professional is that with more resources obtained from the Development Bank System –Sistema de Banca para el Desarrollo, SBD in Spanish– (CEBD, 2017). This incubator is recognized as a successful incubator and has supported 27 companies and generated over \$ 4.9 million dollars in sales (Ávila, 2018; Jiménez, 2013). A critical success factor associated with these results may be due to a more experienced professional profile at the management level, which is a relevant variable to consider according to authors such as Buys and Mbewana (2007), Yong and Moowoon (2006), and Maital, Ravid, Seshadri, and Dumanis (2008).

Organizational Model

Related to the organizational structure, the oldest incubator was created with a traditionalist vision linked to the school of business administration. As for the other two incubators, they belong to an area that reports directly to the Rector's office.

The incubator having more human resources has been labeled as Direction, while the other two have been labeled as project/program; one of this has its own Center of business incubation (ITCR).

The work of leading the incubator is complemented with the use of permanent advisory committees formed by people with a recognized track record in the academic area or in the business sector. The committees give management

support to the incubator director/coordinator in topics ranging from entrepreneurship management to analysis of projects and budgets. The idea is to carry out joint management for decision making.

The entrepreneurs training process differs. The oldest incubator uses its own methodology and the other two incubators use the well-known Lean Startup methodology that concludes with a viable product or MPV (Ries, 2011); none of them has a certified ISO quality system.

The entrepreneurs training is given in the incubators through a specialized methodology. In the case of UNA, this organization also has an institutional program to promote entrepreneurship, which has courses available not only for students but also for external people (open model).

The processes of business incubators are grouped in stages: two of them (ITCR and UNA) group them in a traditional way (pre-incubation, incubation and post-incubation), while the other incubator (UCR) groups them in colored phases which reflect the state of progress in the incubation process (blue, yellow, green and red). Only the UCR does an acceleration process.

The cross-cutting axes of business management were identified for the three incubators and they were related to the projection of each university: science and technology for ITCR; the triple helix of innovation, social and environmental commitment for UNA; and excellence, innovation, technology and teamwork for the UCR.

At a modern level, business incubators make a transversal function through the organization. The methodology and types of services given by the incubator are relevant topics for several authors who point out the importance of the incubation model (Peña *et al.*, 2011), support services (Adesic & Slavec, 2012; Hamdani, 2006) and the components included in the incubation phases (Hackett & Dilts, 2004).

Management Strategies

In the study, one of the incubators was experiencing a re-definition process. The information on the redesign and consequently its new strategies were indeterminate. Concerning the other two incubators, they show a differentiating management strategy that is having a community of mentors and experts able to train potential entrepreneurs according to a well-known incubation model (UCR). They also have a strong filtering process of projects as part of the entrepreneurs training process of the Entrepreneurship Program (UNA: Programa de Emprendimiento) from which national and international projects with social and environmental projection have been obtained.

Having expert advisors in different topics (Hamdani, 2006) is one critical success factor pointed out by incubator managers. Also, for one of the incubators, having an official institutional budget is a success factor. It is widely known that one of the major limitations of entrepreneurship is the lack of financial resources from both public and private entities (Ortin, Salas, Trujillo, & Vendrell, 2007). In this sense, this article is aimed to know the structural dimensions of natural incubators and their main components rather than to deepen into their evaluative elements. Therefore, incubators' efficiency is measured mainly through the progress of the incubated projects and their success level. That provides useful information to be taken as indicators.

According to Voisey, Gornall, Jones, and Thomas (2006) and Hamdani (2016), the performance and impact of the incubators are important measuring variables. In the studied cases, they were measured by using a series of pre-designed parameters such as contribution to innovation (Maital *et al.*, 2008), technology transfer, faster learning (Hackett & Dilts, 2004), preservation of the environment and national or international achievements of incubated projects. In a complementary way, it was determined that the youngest incubator participates in external performance evaluations with a Sweden organization.

Operational Resources

After studying the location of incubators and their human resources, it was found that one incubator has only two employees, and that incubator with more personnel –which also happens to be the last to be established (2012)– had six employees in 2015. Until the date of the interview, the facilities occupied by incubators were owned (1) and rented (2).

The universities provide partial and temporary human support from personnel who work in other departments so that entrepreneurs can use the general services platform or receive more specialized cooperation (such as labs and research centers). Nonetheless, the restriction of human and economic resources limits the incubator's projection. This fact is evident when comparing with a recently created international incubator.

In Costa Rica, none of the incubators (public and private) receive funding from current transfers by the Central Government; a situation that differs from other countries, like Mexico and Spain (Stradi, 2016). As an example, the National Institute for Entrepreneurship (Instituto Nacional de Emprendedores) of Mexico finances local incubators as a strategy to generate new taxpayers (Instituto Tecnológico de Monterrey, 2015). In Spain, the government allocates public funding as an incentive for innovation (Vila, Ferro, & Guisado, 2010).

In countries like Chile, the University of Valparaíso business incubator, named Chrysalis, was constituted in 2010. At the time of the study they had 20 employees, most of them professionals (Stradi, 2016), and had been recognized as an international incubator model for various years. This incubator administrates and invests funds as seed capital for over of \$ 2.3 million dollars and has supported 70 new businesses (PUCV, 2017).

Considering that national incubators finance has similar elements, figure 2 summarizes information about possible sources of funding. This figure shows that one potential source of financing is the SBD, created in 2008 through Law 8634 (Gobierno de la República de Costa Rica, 2008) in order to promote productive development with financial support to new business ideas. Every year, the government appeals for a competition where high-ranked projects receive the opportunity to develop their business idea and receive nonrefundable funds as seed capital.

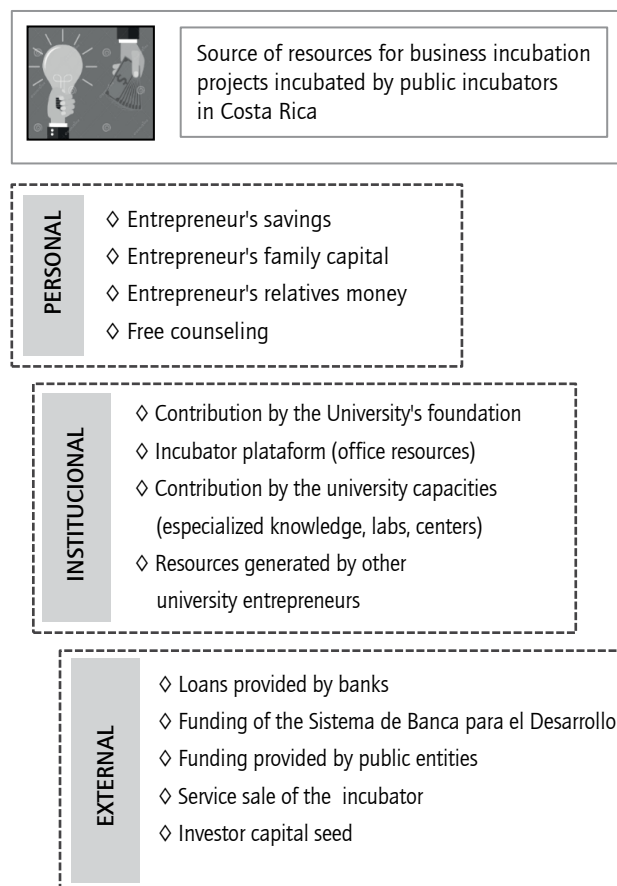


Figure 2. Sources of operational resources for public universities incubators in Costa Rica. Source: own elaboration.

The resources received by incubators come from financial support or subsidies in kind. They can be given by the university, the foundation of the university, financial entities, sales services, and temporary sponsorships. As main source

of funds, one strength of the UNA-INCUBA is formalized financing as part of its budget. Regarding sales services, AUGC is the only incubator that receives funding from dealing its ventures within the university campus (called hangars).

Funding administration for incubation initiatives can also be achieved through the university foundations, even though they are not part of the university structure. University foundations contribute to streamline the use and allocation of resources towards business incubation projects. In this study, the university foundations analyzed were FUNDATEC, FUNDEVI and FUNDA-UNA.

The incubators under study are part of the cost structure of the university they belong to, therefore, the access to funds (Maital *et al.*, 2008), working capital (Buys & Mbewana, 2007; Hamdani, 2006), and support systems (Hacket & Dilts, 2004) are vital aspects for their subsistence provided by these institutions.

Strategic Alliances

The development of the legal framework on entrepreneurship and business incubation in the country dates back to 1990. Existing laws, policies, plans and decrees have formed a legal framework that seeks to promote entrepreneurship. Nowadays, all the incubators are part of the national net RNIA from which cooperation actions are derived, and coordination actions with other public and private organizations of the country are carried out. As Kantis (2017) indicates, the importance of an incubator is that of contributing to "accomplish the development of an extensive offer of financing that covers different parts of the investment and profiles of demanding businesses" (own translation).

Because of the enactment of the Scientific and Technological Development Law 7169 (Ley de Desarrollo Científico y Tecnológico), university incubators were created in 1994, 2011 and 2012. Furthermore, a very important university alliance consolidated between the Commission of National Council of Rectors (Consejo Nacional de Rectores, CONARE) and NEXO, which was born as an answer to the same law (Alfaro, 2016). The GEM Report, gives a view of the entrepreneurship situation in Costa Rica (Lebendiker, Herrera & Velásquez, 2014).

Authors such as Theodorakopoulos *et al.* (2014) and Carayanis and von Zedwitz (2005), among others, have pointed out networking benefits as a development element for incubators and ventures. The benefits of having an incubator network are known and can be described as follow: knowledge of external financing options for entrepreneurs, managers professional updating, experiences exchange, economical support for events and projects, counselling from national and

international experts, contact maintenance and management, training management, and dissemination of initiatives results.

Project Management

All the incubators are focused on assisting timely innovative entrepreneurship that collaborate with the university mission and they are not an alternative of subsistence for the entrepreneur (Nelson, 2015). However, in other Latin American countries, subsistence entrepreneurship is linked to universities in order to generate employment in regions with socio-economic difficulties. Examples of these universities are Autónoma del Estado de Hidalgo in Mexico (Hidalgo, 2015) and the University of Valparaíso in Chile (Gotschlich, 2015).

The three Costa Rican national universities develop entrepreneurship fairs where the interested population present projects that are graded according to applied criteria. The incubator receives several projects per year. Depending on the incubator, indoor incubation registers a maximum of three and a minimum of one reception yearly. All the projects that get into the incubation stage enter a project portfolio and must exceed the pre-incubation stages.

For the proper administration of projects, authors such as Buys and Mbewana (2007) and Aerts *et al.* (2007) point out the importance of having qualified entrepreneurs and considering the personal factors of them (Romo, Quevedo & Herrera, 2013). From this perspective, it was found that in two of the incubators the common feature of successful projects is the existence of technical capacity prior to the execution of the project; this is the base for the development of a good product or service. For the other incubator (UNA-INCUBA), the most relevant feature is having the adequate filters for projects and entrepreneurs.

The use of selection process and the criteria to measure incubation initiatives are described in the literature by authors such as Hacket and Dilts (2004), Voisey *et al.* (2006), and Buys and Mbewana (2007). One of the tools used as selection criteria to choose the beneficiaries (projects) is the evaluation matrix, which is used by one of the incubators (UNA-INCUBA). Having projects with some characteristics like clarity, innovation, multifacetedness, multidisciplinary, dynamism, environmental sustainability, and technology base are other criteria considered by incubators.

When evaluating individual or group entrepreneurs, incubators review that they have an excellent business project (that can lead to salable products, not only to research outputs), the previous knowledge about the business core, the disposition of entrepreneurs to learn new techniques

and to be open-minded for the development of new skills to let grow soft abilities along the incubation process.

The training period for entrepreneurs in each incubator varies from two to six months. External organizational units that are part of the university provide support and counseling to potential entrepreneurs through entrepreneurship programs like Programa de Emprendedores (ITCR and UNA), Programa Proinnova and Red Emprande (UCR). In addition, university research centers support entrepreneurs.

The projects orientation is not restricted to a single topic, and it is related to each university distinctive seal. The ITCR incubator promotes the development of projects related to applied science and technologies. The UCR incubator uses knowledge intensively. UNA's directs its focus on the practical application of knowledge and its triple action axis: economic, social and environmental.

Some successful projects of the national incubators are the following: (i) Siwa: microfiltered natural juices; (ii) Reuti-piña: obtaining the enzyme bromelain for pharmacological use; and (iii) Pet-life: premium nutritional supplement for pets. All the incubators have examples of successful cases on their website.

Two of the incubators submit their projects for evaluation to obtain funds from the SBD. When the entrepreneurs received the funds from the SBD, from the total amount, the incubator charges a percentage that is then reinvested in the same incubation system. The percentages go from 20 (ITCR) to 5 % (UNA). The payment of this percentage is a discrete event that occurs when the project enters the university incubator process, only in that moment and at once.

Student Relationship

Student relationship includes the aspects related to the profile of the entrepreneurs and the university promotion of the new businesses (La Nación, 2014). The average age of entrepreneurs is between 28 and 35 years. Most of them are graduated students (ITCR and UCR) or students (UNA). At ITCR and UCR most of the entrepreneurs are male while at UNA most are female.

Two incubators (UNA and UCR) reported an entrepreneur competency profile that includes aptitudes such as creativity, flexibility, assertiveness, work passion, and mainly leadership. Those agree with the ones described by authors like Ugalde-Blinda, Balbastre-Benavent, Canet-Giner, & Escribá-Carda (2014).

The motivation of some potential entrepreneurs lies in the desire to satisfy the need of accomplishment and personal growth by creating their own business. A study by Stradi (2016) shows that some of the obstacles interviewed

students face are: entrepreneur individualism, development of competencies in the pre-incubation process, and lack of seed capital. The university strengths they visualize are: academic excellence, practical application of knowledge, available specialized infrastructure, and the counsellors and professors' highly specialized expertise. These aspects can be projected towards their specific incubator processes too. This university level promotes entrepreneurship through an entrepreneurial program especially if something similar does not exist in the faculties/majors. Consequently, it is essential to promote entrepreneurship in the student's mind and to create a relationship tied to the university (Hackett and Dilts, 2004; Hamdani, 2006; Morales, Pineda & Ávila, 2012; Rikap, 2012).

International Business Incubators Experiences

This section was aimed to model the system of the national incubators studied and to complement this information with relevant aspects from other successful university business incubators (Versino, 2000). The original purpose of the study was not to study the comparative characteristics of the five incubators, but to reinforce important concepts based on international experiences.

Making a 1-1 comparison with these foreign universities was unnecessary since the scope of the research objective of the study was local and the socioeconomic realities of countries differ in various aspects, such as geography, distances, country development, socio-economic and educational profile, subsidized budgets, among others.

The two business incubators interviewed belong to prestigious universities and their analysis is based on the answers provided in the questionnaire. The incubators were the High Technology Business Incubator of the Universidad Autónoma del Estado de Hidalgo, Mexico, and the Business Incubator of the Pontificia Universidad Católica in Valparaíso, Chile. The areas of study for these incubators were divided into topics: generalities, incubator type, project management, entrepreneurship, and regionalization. The elements of each topic are similar to those studied with national business incubators; however, in this case, they are concentrated in five relevant topics with 25 items of analysis.

In addition, the research includes an area of study related to regionalization, since studying how these incubators having different assistance centers in the country manage the entrepreneurs' learning strategy was necessary to consider options for the distance education processes. Besides, the national business incubators studied did not have distance education processes in this area. Consequently, including international experience in the study is relevant.

The analysis reveals that both incubators have a significant historical record. They have been funded by both the central government and private entities. They receive mainly external entrepreneurs and are consolidated organizations with multiple projects administered by specialized professional personnel. A difference with the national incubators is that these incubators do receive funding which has an effect in their capacities of accomplishment.

The Mexican incubator works with a limited focus on technological base enterprises (EBT businesses). It runs a network of business incubators, and for distance training of human resource they use virtual communication tools complemented with the predominant face-to-face system of the university. This type of model can be used by distance education systems to provide methodologies of business incubation.

The Chilean university incubator focus on the creation and development of start-ups, spin-off and EBTs and has locations in two cities and links with technology, innovation and business centers. Despite being recently created, the Chilean university incubator has a significant amount of personnel and its management has been recognized internationally due to important results related to the level of creation of start-ups and wealth generation.

The Chilean government has given much support to the issue of creating new enterprises and created CORFO Project (VERDE, 2016) that is an initiative which promotes start-ups in the country.

According to international experiences, the measurement of the effectiveness and impact of the incubator's performance can be evaluated with international indexes. Getting good results in these evaluations facilitates obtaining capital resources for the incubator. An example is Chrysalis incubator in Chile, which received the Top Challenger of Latin America recognition from UBI World Benchmark Study 2017-2018 (PUCV, 2018). This shows that universities are ready to break the paradigm to venture into the development of new businesses through their organizational units. In addition, the methodology used by the Chilean incubator is internationally well-known. As Ries (2011) describes, Lean Startup "is a group of practices which help entrepreneurs increase the probabilities of creating a start-up with success" (p. 64, own translation).

Chilean incubators key success factor is having a good business idea and entrepreneurial quality projects. On the other hand, the Mexican incubator, which uses its own methodology, emphasizes the entrepreneur's training, qualified counselling availability and project monitoring. Multiple studies, as that developed by Romo, Quevedo, and Herrera (2013), address the efforts made by some Mexican

universities in relation to the entrepreneurship programs and their relationship with the students.

Regarding the mechanisms to increase self-employment, the Chilean incubator admits opportunity entrepreneurship, and the Mexican incubator accepts subsistence entrepreneurship. The biggest obstacle for the entrepreneurs in Mexico is to find financing, the same problem detected in the national incubators studied. However, for the Chilean incubator the main problem is the management of supply-demand affairs and liquidity.

Incubators managers recommend the following tip to any new incubator: standardize the entrepreneurs assertively through a robust business incubation program that allows the students to develop the necessary competencies according to the university own academic seal to take advantage of the capacities developed and the competitive advantages of each university.

Conclusions

This article was intended to describe Costa Rican public incubator system. Independently of the type of project that required their support, incubators have certain common characteristics grouped into categories. As a result of this study, eight categories of analysis were generated with 81 descriptive elements.

The development of this research contributed in a significant, creative, and innovative manner to enlarge the existing knowledge about business incubation models, especially those linked to public universities. This study also gave an integral vision of the path that university incubators take in some Latin American universities, which starts with a project linked to a school, program or research center that evolves according to the structure, the initiative, the coordinator's experience, the available institutional resources, and the political support.

The economic subsidies given through specific laws to promote business incubation provides a significant push to the management of incubators, evidenced by countries such as Spain, Mexico and Chile. In contrast, current public policies on entrepreneurship result insufficient to promote the development of business incubation systems in Costa Rica. The allocation of funds by the government is required to promote the strengthening of the RNIA as a local development promoter.

The main cross-cutting axes of incubators management were innovation, excellence, science and technology, social and environmental commitment.

In the systems studied, an outstanding and relevant action strategy is having an entrepreneurship program, which independently of its position in the university organic structure can promote technical competencies and soft skills in entrepreneurs in order to feed competitive business projects.

All the universities receive projects on different topics (there is no restriction about it) and with diverse methodologies. Then filters are applied to accept those projects with real possibilities of success. Any incubator that generates a new incubation model must establish those criteria to design and implement this process and then be able to use technological transfer through training with an equivalent university.

This study clarifies the strategy used by universities in other countries with extensive territory. Entrepreneurs training is driven through regional campuses and the use of virtual means of communication.

This is an especially observed feature in the case of distance education systems, since they have the advantage of holding powerful communication platforms and are willing to create a new incubator to provide incubation services to the university population in tune with its mission of assisting remote areas with difficult access to traditional education.

Directive and Academic Implications

Results provide systemized and detailed first-hand information about the functions of public universities business incubators. Substantial differences in the focus of each incubator can be recognized; those are associated to the way in which the accomplishment of each university mission is presented. This aspect must be considered by any other entity planning to develop the identity of its own business incubator in the future.

The results from the three models provide an idea on how university entrepreneurship is being handled in public universities in this country, making use of the existing university policies and resources such as the mentors' scientific knowledge and specialized university areas.

At the managerial level, public universities authorities must formulate specific business incubation policies that can result in effective action strategies in short and medium terms. Another important finding is that the patriarchal vision in Costa Rica falsely finds those activities to promote entrepreneurship against the university social function. Consequently, puts the sources of funding at risk. Therefore, the first step to strengthen business incubators is to get a real institutional commitment that will lead to operational resources for the incubators; on the contrary, there is a lack of a real commitment.

Limitations and Future Research Lines

The study developed considers a greater scientific relevance taking into consideration that in our country the studies developed are mostly on the topic of specific cases such as spin-off affairs.

International entities/institutes have generated efficiency metrics to assess the predefined parameters for a business incubator. Nonetheless, the results of these studies are not public and tend to have a significant cost. This study gives the researcher the possibility to undertake parallel studies to make the knowledge found public and, consequently, contribute to provide the equity in access of highly innovative information in higher education.

In subsequent studies, researchers can use these results as a starting point to develop indicators, considering that this research has contributed to determine analysis categories and 81 elements that can be used as an input to build new questionnaires based on semi-quantitative or quantitative methodologies. For instance, in the external evaluation of an incubator efficiency, a rubric on the vision of several authors about measuring important categories and elements can be implemented.

The information hereby presented could be complemented with other studies in order to establish a measurement method that can be used to obtain a diagnosis of a group of incubators and monitor their progress.

Disclosures

The author declares no conflict of interest.

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