

Identification of Clusters of the Scientific Production on Business Incubators

Francisco Valdivino Rocha Lima¹, Fabrício Carvalho da Silva², Gilton José Ferreira da Silva³, João Antonio Belmino dos Santos⁴, Ana Eleonora Almeida Paixão⁵

¹Department of Management and Business, Federal Institute of Piauí, Brazil
Email: valdivinorocha@ifpi.edu.br

²Federal Institute of Piauí, Campus Uruçuí, Brazil
Email: fabriciocarvalho@ifpi.edu.br

³Department of Computing, Federal University of Sergipe, Brazil
Email: gilton@dcomp.ufs.br

⁴Department of Food Technology, Federal University of Sergipe, Brazil
Email: joaoantonio@ufs.br

⁵Post-Graduate in Intellectual Property Science, Federal University of Sergipe, Brazil
Email: aepaixao@gmail.com

Abstract—Business incubators are increasingly important institutions in the economic scenario and focus of countless scientific researches. The objective of this work was to identify the clusters of the international scientific production on business incubators, through bibliometric analysis. We analyzed publications from the period 1984 to 2017, through a systematic mapping in periodicals and annals of congresses. Four clusters on the subject were identified: (i) implementation and management of incubators; (ii) management of companies served by incubators; (iii) incubation, knowledge transfer and competitiveness at the regional level; and, (iv) entrepreneurial education and culture in the context of higher education institutions. The cluster construction of scientific publications on business incubators points to technology scenarios, business models, and innovation strategies.

Keywords—Business incubation, bibliometrics, scientific clusters.

I. INTRODUCTION

Business incubators are mechanisms developed around the world to implement policies to support innovation and business growth, especially in technology-oriented companies. They constitute dynamic processes for the formation of entrepreneurs and enterprises, financed by investments of various natures and supported by the intellectual and technological assets of training and research. Incubator activities involve a variety of services and infrastructure that support startup ventures, greatly increasing the chances of success [1], [2].

The role of incubators in the development, growth and consolidation of companies has attracted the attention of researchers in the field of economics and management in the last 35 years [3], [4]. For this reason, a significant number of scientific works have been published, at the international level, on the various particularities that involve these institutions.

Most incubator studies are financed by governments, through universities or research centers [5], showing a proactive position in promoting the ideal conditions for regional economic development. In fact, in a knowledge-based economy, universities become the base elements of the innovation process [6].

In this context, the objective of the present study was to identify the clusters of the international scientific production on business incubators, from 1984 to 2017. The choice of bibliometric approach is justified by the fact that an analysis of academic production in a longitudinal way allows the incorporation of several theoretical perspectives and their relations over time, constituting a useful format to understand the evolution of a certain area of knowledge.

II. BUSINESS INCUBATORS: ORIGIN AND DEFINITION

The United States pioneered enterprise incubation programs because of three simultaneously developed processes: (i) corporate condos; (ii) various investments in new technology companies; and, (iii) focus on entrepreneurship programs. These initiatives were implemented by the National Science Foundation, which,

in partnership with the largest universities in the country, developed actions to stimulate the generation of innovation in research centers by students and teachers, as well as the transfer of knowledge and technologies produced in the academic field to society [7], [8].

The literature on business incubators contains a large number of similar definitions. One of the most commonly cited definitions of business incubators in scientific work is the definition of the International Business Innovation Association (InBIA). According to this association, a business incubator is a means of business support, which effectively accelerates the development of small enterprises, providing entrepreneurs with resources and services in the initial period in which they are more vulnerable [9], that is, is an entity with technical, managerial, administrative and infrastructure capacity to provide the small entrepreneur with mechanisms for growth[10].

Incubators are created with the objective of providing, during the incubation period, the necessary capacities so that, after incubation, companies are more likely to adapt to the market, generating competitive advantages over other companies in the sector, through innovation and application of technology, supporting local and regional economic development. In addition, it seeks to support the entrepreneur himself, preparing him for the management of his business. In this way, the incubation process results in a key factor so that competences are acquired in an adequate way, fulfilling the objective for which the incubators were created[11], [12].

III. METHODOLOGY

In the present bibliometric analysis, we used data from the scientific production on Business Incubators based on articles published in periodicals and congress annals indexed in the Web of Science. The study was carried out in six stages: (a) definition of the research theme; (b) choice of database; (c) elaboration of the search protocol; (d) search performance; (e) identification of clusters of scientific production on the subject; and, (f) analysis of identified clusters.

The keywords "Business Incubator" and "Business Incubation" were used, considering only the publication in which at least one of them was present in the title, abstract and / or keywords of the work. This research methodology is especially used in the area of technology and information science. The data were processed using *VosViewerSoftware*.

IV. RESULTS AND DISCUSSION

After the application of the search criteria defined in the methodology, 473 works were identified with the keyword *Business Incubators* and 121 works with the keyword *Business Incubation* in the period from 1984 to 2017. Subsequently, we excluded duplicate papers, obtaining a total of 534 papers, covering the two keywords defined for the study. It was observed that the first publications on business incubators occurred in 1984, as shown in Figure 1.

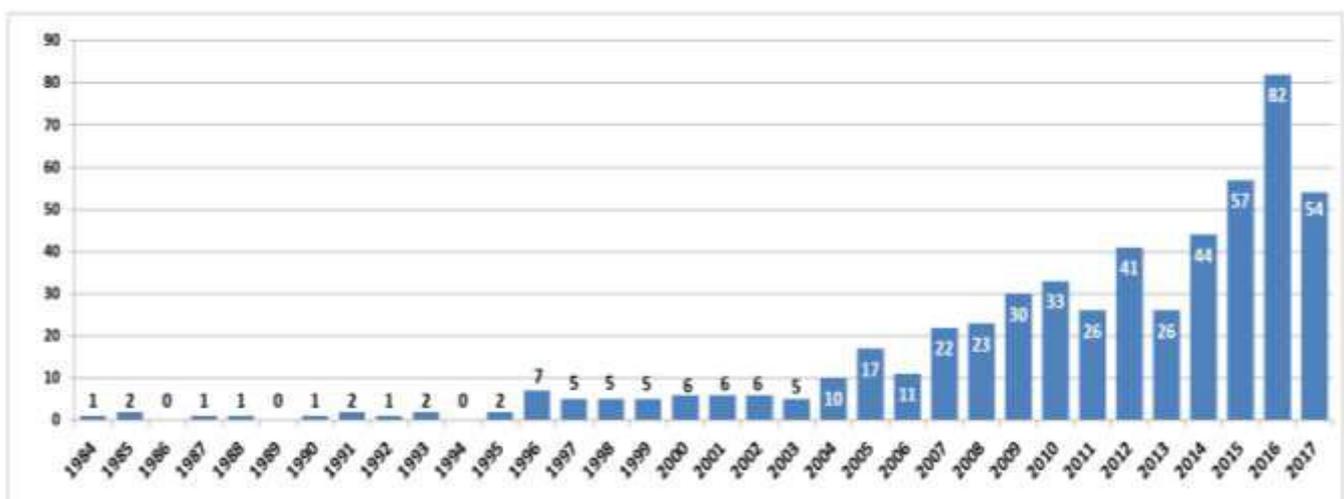


Fig. 1: Number of publications on business incubators, 1984-2017

In Figure 2, it is presented a network of occurrence of common terms in the set of works analyzed, which resulted in the formation of clusters of the main research areas. In the network visualization, the terms are represented by their label and by a circle, whose size

determines the weight of each of them, in relation to the number of linked works and the number of times these have been cited. The color determines the cluster to which the term belongs and the lines between them represent links (cocitation). The distance between two terms in the

visualization indicates the relationship between the content of the works to which they are linked, in what concerns cocitation.

For the construction of the network, the following criteria were established: (a) the terms were extracted from the title and of the summary of each article; and (b) the minimum occurrence of each term in the work set should be 20. In total, the incidence of 9,181 terms was identified in the 534 papers analyzed, of which only 138 met the criteria established above. The network was structured in four clusters, identified in Figure 1 by the colors red, blue, green and yellow.

The first cluster (red) are topics related to the management and operation of incubators, such as incubation process, management models etc. The second cluster (blue) is related to the management of companies linked to incubators, with emphasis on terms such as performance, relationship and managerial effectiveness. The third cluster (green) includes terms related to regional aspects, including the name of countries such as Germany, Russia, etc. Finally, the fourth cluster (yellow) is related to entrepreneurship in the academic sphere, focusing on topics such as creativity, entrepreneurial culture, among others.

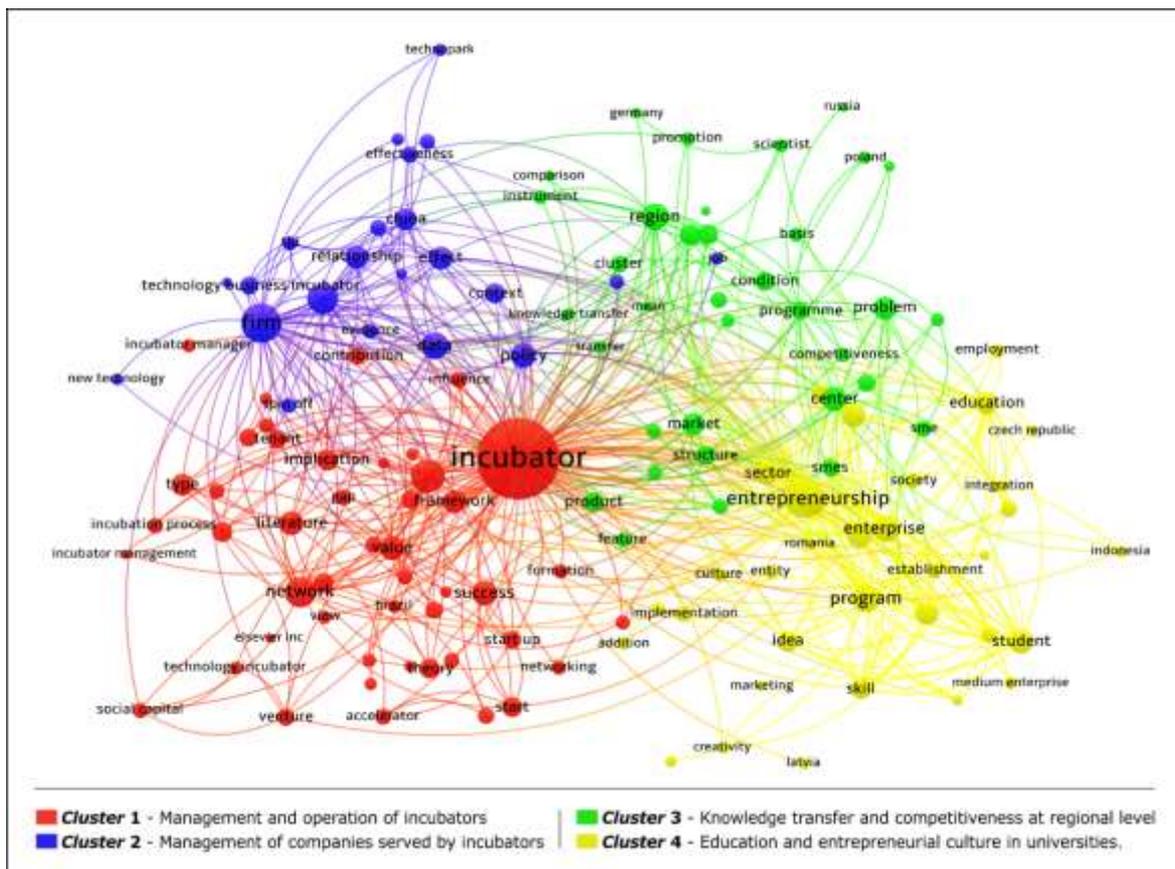


Fig. 2: Clusters of scientific production on business incubators

In the period from 1984 to 2003 - the first 20 years of the historical series analyzed - only 58 publications, developed almost exclusively in the United States and whose thematic focus was directed to the implantation and management of incubators of companies. From 2004, however, there is a gradual increase in the number of published works, with a focus on the dissemination of the entrepreneurial culture in the academic scope and management of companies resident in incubators. In addition, a broader geographic coverage is observed in the research focus, strengthening the growth and consolidation of the other clusters characterized in the

present study.

V. CONCLUSION

The analysis of clusters of the scientific production related to the incubator of companies highlights research related to the management and operationalization of these institutions, incubation process, management models, management of resident companies, transfer of knowledge and competitiveness in the regional scope (results of governmental policies) and works with focus on entrepreneurship, specifically related to the creativity and entrepreneurial culture in the academic scope, the

identification of publications on the subject of business incubators on a scientific basis points to possible scenarios of technology, business model and innovation strategies. In addition to highlighting the characteristics and directions of studies already published, it allows the understanding of the gaps for specific studies, in order to contribute to the definition of a research agenda in the area.

pp. 254–267, May 2007.

- [12] N. Roth, A. Brem, and N. Kreusel, “European business venturing in times of digitisation - an analysis of for-profit business incubators in a triple helix context,” *Int. J. Technol. Manag.*, vol. 76, no. 1/2, p. 104, 2018.

REFERENCES

- [1] J. M. Shepard, “When incubators evolve: new models to assist innovative entrepreneurs,” *Int. J. Entrep. Innov. Manag.*, vol. 21, no. 1/2, p. 86, 2017.
- [2] H. Zhang, W. Wu, and L. Zhao, “A study of knowledge supernetworks and network robustness in different business incubators,” *Phys. A Stat. Mech. its Appl.*, vol. 447, pp. 545–560, Apr. 2016.
- [3] S. Mian, W. Lamine, and A. Fayolle, “Technology Business Incubation: An overview of the state of knowledge,” *Technovation*, vol. 50–51, no. 4, pp. 1–12, Apr. 2016.
- [4] M. Schwartz and C. Hornych, “Cooperation patterns of incubator firms and the impact of incubator specialization: Empirical evidence from Germany,” *Technovation*, vol. 30, no. 9–10, pp. 485–495, Sep. 2010.
- [5] Á. R. Vázquez-Urriago, A. Barge-Gil, and A. M. Rico, “Which firms benefit more from being located in a Science and Technology Park? Empirical evidence for Spain,” *Res. Eval.*, vol. 25, no. 1, pp. 107–117, Jan. 2016.
- [6] M. Ranga and H. Etzkowitz, “Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society,” *Ind. High. Educ.*, vol. 27, no. 4, pp. 237–262, Aug. 2013.
- [7] N. Mahmood, C. Jianfeng, F. Jamil, J. Karmat, M. Khan, and Y. Cai, “Business Incubators: Boon or Boondoggle for SMEs and Economic Development of Pakistan,” *Int. J. u-and e-Service, Sci. Technol.*, vol. 8, no. 4, pp. 147–158, Apr. 2015.
- [8] M. P. Rice, “Co-production of business assistance in business incubators: an exploratory study,” *J. Bus. Ventur.*, vol. 17, no. 2, pp. 163–187, Mar. 2002.
- [9] International Business Innovation Association (InBIA), “Business Incubation,” 2018. [Online]. Available: <https://inbia.org>.
- [10] D. Săvescu, “Research for Business—a New Concept and a Case Study,” in *2nd International Conference on Applied Social Science - ICASS*, 2012, pp. 339–344.
- [11] K. Aerts, P. Matthyssens, and K. Vandenbempt, “Critical role and screening practices of European business incubators,” *Technovation*, vol. 27, no. 5,