HIGH IMPACT DRIVERS IN INNOVATION ECOSYSTEMS: THE CASE OF TECNOPUC-FBK JOINT LAB

Eduardo Giugliani[1], Sandro Battisti[2], Rafael Prikladnicki[3], Paolo Traverso[4]

Abstract. *Innovation ecosystems are developing new organization models of collaboration towards sustainability and creation of high impact. It requires the development of new ways of collaboration, both from the academic and company's point of view. This research analyzes the way of working of two innovation ecosystems that are highly supported by Information and Communication Technology (ICT). This way helps research, companies, and society to address their needs by the identification of four impact drivers of success, which are: consultancy, collaboration, education, and mobility. The main finding observed during the long-term collaboration of two innovation ecosystems extends the field of living labs and innovation platforms. Further research could validate and measure the success of the four drivers in the generation of high impact. The research presents practical implications for managers of innovation ecosystems.*

Keywords: *innovation ecosystems; innovation platforms; collaborative innovation; open innovation; living labs.*

[1] Global Tecnopuc. Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre – Brazil. Email: giugliani@pucrs.br
[2] Center for Information and Communication Technology. Bruno Kessler Foundation (FBK), Trento – Italy. Email: s.battisti@fbk.eu
[3] Global Tecnopuc. Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre – Brazil. Email: rafael.prikladnicki@pucrs.br
[4] Center for Information and Communication Technology. Bruno Kessler Foundation (FBK), Trento – Italy. Email: traverso@fbk.eu

1 INTRODUCTION

Organizing innovation for high impact is an emerging issue for researchers and managers, where the role of key actors can be crucial for the high impact, an argument supported by Pisano and Verganti (2008). Innovation parks and business ecosystems seem to be the most effective ways to create environments capable of delivery both business and societal impact towards sustainability, which is also supported by Seebode et al. (2012) and Adner et al. (2017).

This research addresses collaborative innovation models capable of delivering measurable results to companies (e.g. Bogers et al. 2017) and society, addressing key drivers and exploring the innovation ecosystems around living labs. Additionally, this research adopts the definition of Katzy et al. (2012) for living labs, "innovation intermediaries that coordinate network partners for the execution of innovation processes with the engagement of end-users for which they provide the technical and organizational infrastructure", which is supported by Howells (2006).

Innovation ecosystems are a powerful way of creating conditions to catalyze economic growth, and there is a need to explore its success factors (Oh et al. 2016), in particular, towards the societal high impact by increasing employment rate and quality of life of local citizens. From this perspective, Winter et al. (2017) argue about the success factors of mobile ecosystems by analysis the role of technology in creating platforms of collaboration for companies and users. This research expands the theory by creating new drivers for performance measurement in innovation ecosystems, as suggested by Ritala and Almpanopoulou (2017). And, this research also explores new opportunities for identifying new constructs to be measured, which could be directly related to ecosystem performance and capability (e.g. Adner et al. 2017).

From this perspective, the research question is: *What are the main drivers for the collaboration of innovation ecosystems that enables performance measurement towards the high impact on business and society?*

2 LITERATURE REVIEW

The background research used to understand this phenomenon is at the intersection between organizational innovation (such as living labs) and innovation platforms (e.g. Gawer and Cusumano, 2014). Furthermore, the organization innovation body of knowledge focused on living labs (i.e. Battisti, 2014) leverages Information and Communication Technology (ICT) as the central mechanism of support for high impact creation, via the participation of organizations

and people. It enables powerful actions for dealing with societal challenges, in particular exploring key actors, such as social entrepreneurs' roles and motivations for driving high impact, as suggested by Surie (2017).

Technology and innovation ecosystems can be considered organizational structures aimed at enabling research, development, and production of technology towards the development and growth of companies, as supported by Clarysse et al. (2014). Furthermore, Giugliani et al. (2014) argue about the importance of ICT to support the governance and development of innovation ecosystems (e.g Bogers et al. 2017), in particular considering the complexity involved in the ecosystems after worldwide financial and social crisis. Additionally, Battisti (2014) argues the collaboration between companies and society towards undressing the most pressing issues must be a key driver, and he suggests the creation of living labs as the main mechanism to foster innovation for high impact creation in the academia, in the business arena, as well as in society. It could be useful for supporting ecosystem managers (Borgh et al. 2012).

The knowledge-intensive companies play a crucial role in the success of innovation ecosystems and creation of high impact, as supported by Chiaroni et al. (2008), Battisti (2012) and Borgh et al. (2012). Aiming at extending the value creation of knowledge-intensive, Pompermayer et al. (2016) and Battistella et al. (2017) argue about the importance of creating the mechanisms (e.g. business accelerators) that enable the launch of global-born companies, which potentially can create disruptive platforms for long-term competitive advantage.

Understanding the dynamics of innovation ecosystems could be a way to predict and act towards high impact. In this way, Ghallab et al. (2014) argue the need to focus on the key actors to address technology development, "action" in a conceptual way is a world-transformation step that can be used to perform a task (i.e. a specific action that affects the process of solving needs). Furthermore, this specific action could change based on the environmental dynamicity of the place where this task is performed, an argument supported by Pistore et al. (2006).

Dynamic environments require rapid developments within innovation processes and quick innovation outcomes of specific projects or joint collaborations. It is a requirement to deal with stakeholder needs while exploring the advantages of technology evolution, in particular, due to the nature of temporary advantage of products launched in the markets by SMEs (e.g. Battisti, 2013). Furthermore, Ghallab et al. (2016) argue that literature models are mature to deal with some project constraints, as time, resources, continuous change in the requests of society, the need to manage the request of multiple stakeholders, and uncertainty. And, they argue about the need of creating new collaborative planning, in order to handle time and uncertainty in a proper way, considering the dynamics of the environment (e.g. Pistore at al., 2014). Moreover,

Schweitzer et al. (2011) suggested that open innovation is more beneficial for companies in dynamic, rather than stable conditions, and Prikladnicki et al. (2003) argue that global open software development can increase the competitive advantage of companies.

3 METHODOLOGY

This paper applied "action research methods" considering the dynamicity of the phenomenon under study. It focuses on clinical inquiry research (Schein, 2008), which is the most appropriate method to describe and analyze the collaboration between the actors and their ecosystems. In particular, clinical inquiry research enables the researchers to collect data from the empirical field in the most actionable way, obtaining more in-depth and detailed information when compared with other research methods, such as single case studies.

The data collected from Jan/2013 and December/2016 was considered as the main source for analysis, in particular, direct observations and interactions of the researchers with key actors inside the two innovation ecosystem, including public and private organizations, as well as citizens in the cities of Porto Alegre/Brazil and Trento/Italy.

The mains motivation for the case selection is the fact the researchers actively working in the two institutions during the research period, having in-depth access to confidential information that was crucial for the case analysis and findings. Furthermore, it was necessary day-by-day interaction with the middle and top management of the two ecosystems, in order to understand the key public and private institutions that interact with TECNOPUC and FBK, and the way they collaborate towards innovation and high impact.

4 CASE ANALYSIS

This research analyzed the collaborative model of innovation developed by TECNOPUC, the Science and Technology Park of Pontifical Catholic University of Rio Grande do Sul (PUCRS) in Porto Alegre, Brazil and Fondazione Bruno Kessler (FBK) in Trento, Italy. This model was defined "TECNOPUC-FBK Joint Lab". From the TECNOPUC side, the main actors, resources, and individual innovation models have been mapped by a recent study of Lamb et al. (2016), which prove the potential impact of this ecosystem. Their goal is to create a community of interdisciplinary research and innovation through academic-industrial-government collaborations, to improve their competitive position in the world and enhance the quality of life.

FBK is an internationally recognized Research Foundation, conducting scientific research in the areas of Information and Communication Technology, Advanced Materials and Microsystems, Theoretical and Nuclear Physics and Mathematics Research. The focus is to conduct excellent research and foster the realization of software systems, experimentation in realistic settings, validation on the field by living labs, industrial applications and high impact to market and society, which prove the high commitment on addressing societal impact. In addition, FBK carries out its mission by disseminating and publishing results and transferring technology to companies and public entities.

From this perspective, and towards combining the two innovation ecosystems for the creation of high impact in society, the Joint Lab performed the actions presented in Table 1.

Table 1: Joint lab main actions

TOPIC	DESCRIPTION
Special projects	Development of research and technology projects for private firms, local governments, or other public agencies to design tools to foster better organizations and societies, leveraging on fundraising from European and Brazilian funding agencies; considering project complexity as a key factor.
Education	Creation, development and operational support of joint Ph.D. programs and post-master courses in business, innovation, knowledge management and interdisciplinary studies, which are strongly connected with the fields of Engineering, and Computer Science
Consultancy	Consultancy services to public and private organizations, addressing the intersection between innovation management, knowledge management, and other interdisciplinary areas
Social Innovation	Development of ICT-based social innovation projects. The lab explores this paradigm to research, develop, deploy and test new technologies, to improve organizations, cities, and societies, in order to help on solving social issues in Brazil and Italy, boosting to merge interdisciplinary fields
Exchange	Exchange of students, researchers and faculty staff between the parties, in order to promote the exchange of knowledge, joint teaching activities and seminars, and face-to-face collaborations in projects
Co-creation	Development of creativity and co-creation activities for new processes and services based on design thinking for understanding needs, and agile methodologies to implement technologies that cope with stakeholders' needs
Acceleration	Synergy for the acceleration of new business opportunities between companies and final customers, as well as technology transfer from the research to the target markets; considering the management under uncertainty a key driver for the selection of startup for acceleration.
Go-to-market	Support the launch and growth of high scalable start-up around the innovation ecosystems (e.g. technology-based innovation platforms), in order to enhance technology and business developments towards the go-to-market actions.

From the analysis of the activities performed by the Joint Lab, this research categorizes the main similarities and complementarities of the lab towards the identification of the main drivers of success. Thus, the main observed "similar characteristics" are presented in Table 2.

Table 2: Joint lab similarities

TOPIC	DESCRIPTION
Co-working	Companies are co-located in close collaboration with researchers.
Labs with Corporations	Special laboratories with key companies in FBK (e.g. TIM, Engineering and FCA Group) and in Tecnopuc (e.g. HP, Dell, Stefanini and Microsoft).
Industrial PhD students	Students that are co-funded by the companies for the development of state-of-the-art research to address practical problems of the companies.
Research field	Tecnopuc and FBK main research field is ICT, which is also the domain that enables the major number of opportunities for joint research that enabled innovation.
Territorial level	There is strong synergy with regional and local governments in Trento and Porto Alegre, as well as the strong synergy with other innovation actors. FBK with HIT (Hub Innovazione Trentino) and Tecnopuc with the Hub of Science and Technology with UFGRS (The Federal University of Rio Grande do Sul).

Furthermore, the main observed "complementary characteristics" are presented in Table 3.

Table 3: Joint lab complementarities

PILLARS	FBK	TECNOPUC
Research towards innovation	High H-index of researchers with a good potential for innovation	Transfer of research into business opportunities
Management of innovation	Expertize in capturing financial resources from H2020 framework	Provide experience of managing projects in the agile way
Marketing opportunities	Develop high quality technology to transfer to Brazilian companies	Offers a hub to Latin America market
Education	Receive international students from TECNOPUC	Provide Ph.D. student to join the international Ph.D. program of FBK

5 DISCUSSIONS AND CONCLUSIONS

The main contribution of this research is four drivers of success, which enables the strong collaboration of the innovation ecosystems towards high impact (see Table 3).

Table 3: Four drivers of success

DRIVER	DESCRIPTION
1. **Consultancy:** Public and private funding support to address business and social needs	It is about carry-out external consultancy for developing and managing strategic projects, in order to understand and address the requests of public and private organizations, including co-creation activities with citizens
2. **Collaboration:** Small-medium companies are developing products with society and academia	It is about the supporting of new business opportunities between companies towards strong collaboration and knowledge creation, including soft-landing of start-up between Trento and Porto Alegre.
3. **Education:** Companies and society needs are empowering academic to promote joint research	It is about the promotion of Joint PhD programs in the areas of Computer Science and Materials Engineering and Technology, which is key to prepare the next generation of tech people that should be ready to unpredictable social challenges.
4. **Mobility:** Researchers are collaborating together in specific physical places	It is about to provide the physical infrastructure to support people to have a period abroad, focusing on understanding the pain points of researchers, companies, and society.

The top management of the two ecosystems seems to take into consideration the management of innovation under uncertainty as a critical factor, considering that as the main issue that is pressing Italy and Brazil in the current economic, social and political scenarios. On one hand, the Italian economy is not growing, and the unemployment rate is increasing. It is also caused by the fact that European Union is changing its economic and social models and movements of separation of frontiers are growing. On the other hand, the forecasted Brazilian economic growth seems to be far from the expectations of the financial markets, thus not following the BRIC results in terms of economic development.

By understanding joint lab activities, this research identified four drivers for the success of sustainable collaborations in research and innovation, expanding open innovation theory such as the research of Bogers et al. (2017). Furthermore, these drivers extend the fields of living

labs (e.g. Katzy et al. 2012) and innovation platforms (Gawer and Cusumano, 2014), in particular by confirming the elimination of bottlenecks connections among actors is a key success factor of innovation ecosystems, as argued by Oh et al. 2016.

The practical implications for academia, companies, and society are summarized as follows: intensive work together considering the agendas of organizations; focus on narrow topics and deliver small and impactful results; apply Agile methodologies to develop research and innovation; prioritize key actions to deliver impact to the industry and society; satisfy stakeholders, considering the different priorities for the Countries/Regions.

Limitations are the analysis of two innovation ecosystem in a qualitative way, focusing on finding similarities and complementarities for the creation of high impact driver. This limitation open avenues for further research in innovation platforms and living labs fields, in particular, researchers could validate the drivers via a quantitative method, as well as create a new measurement of performance model that includes the four drivers. Furthermore, the open innovation field of research could be extended by measuring the effects (i.e. short, medium and long-term) of the joint lab activity throughout the involved local territories.

REFERENCES

Adner, R. (2017). Ecosystem as structure: an actionable construct for strategy. *Journal of Management*, Vol.43, No.1, pp.39-58.

Battistella, C., Battistella, C., De Toni, A. F., De Toni, A. F., Pessot, E., and Pessot, E. (2017). Open accelerators for start-ups success: a case study. *European Journal of Innovation Management*, Vol.20, No.1, pp.80-111.

Battisti, S. (2012). Social innovation: the process development of knowledge-intensive companies, *International Journal of Services Technology and Management*, Vol. 18, Nos. 3/4, pp. 224-244.

Battisti, S. (2013). Social innovation in dynamic environments: organising technology for temporary advantage. *International Journal of Social Entrepreneurship and Innovation*, Vol.2, No.6, pp. 504-524.

Battisti, S. (2014). Social innovation in living labs: the micro-level process model of public-private partnerships. *International Journal of Innovation and Regional Development*, Vol.5, No.4/5, pp. 328-348.

Bogers, M., Zobel, A. K., Afuah, A., Almirall, E., Brunswicker, et al. (2017). The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. *Industry and Innovation*, Vol.24, No.1, pp.8-40.

Borgh, M., Cloodt, M., and Romme, A. G. L. (2012). Value creation by knowledge-based ecosystems: evidence from a field study. *R&D Management*, Vol.42, No.2, pp.150-169.

Chiaroni, D., Chiesa, V., De Massis, A. and Frattini, F. (2008). The knowledge bridging role of technical and scientific services in knowledge-intensive industries, *International Journal of Technology Management*, Vol. 41, Nos. 3/4, pp.249–272.

Clarysse, B., Wright, M., Bruneel, J., and Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, Vol.43, No.7, pp.1164-1176.

Gawer, A., and Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3), 417-433.

Ghallab, M., Nau, D., and Traverso, P. (2014). The actor's view of automated planning and acting: A position paper. *Artificial Intelligence*, 208, 1-17.

Ghallab, M., Nau, D., and Traverso, P. (2016). *Automated Planning and Acting*. Cambridge University Press.

Giugliani, E.; Selig, P.M; and dos Santos, N. (2014). Innovation parks as alternative to regional development facing the world crises: a governance model. In Benedicto, J. L.L. *Tipologias de regions en la Union Europea y otros estudios*. Pp.111-144.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation, Research Policy, Vol. 35, No.5, pp. 715-728.

Katzy, B.R., Pawar, K.S. and Thoben, K-D. (2012). Editorial: A Living Lab Research Agenda, *International Journal of Product Development*, Vol.17, Nos.1/2, pp.1-7.

Lamb, C. S.; Giugliani, E.; Prikladnicki, R.; Evaristo, J. R. (2016). Strategic Planning Mapping - O Processo de Aceleração de Sinergias do TECNOPUC. In: *CIKI - Congresso Internacional de Conhecimento e Inovação*, Bogotá. Colombia.

Oh, D. S., Phillips, F., Park, S., and Lee, E. (2016). Innovation ecosystems: A critical examination. *Technovation*, Vol.54, pp.1-6.

Pisano, G. and Verganti, R. (2008). Which kind of collaboration is right for you?, *Harvard Business Review*, Vol. 86, No. 12, pp.78–86.

Pistore, M., Bettin, R., and Traverso, P. (2014). Symbolic techniques for planning with extended goals in non-deterministic domains. *Proceedings of the Sixth European Conference on Planning*. pp. 166-173.

Pistore, M., Spalazzi, L., and Traverso, P. (2006). A minimalist approach to semantic annotations for web processes compositions. In: *European Semantic Web Conference*. pp. 620-634. Springer.

Pompermayer, L.; Prikladnicki, R.; Torrescasana, S.; Giugliani, E. (2016). From ideas to post incubation: Generating global-born companies at TECNOPUC and RAIAR. In: *33rd IASP World Conference*, Moscow. Russia.

Prikladnicki, R., Nicolas Audy, J. L., and Evaristo, R. (2003). Global software development in practice lessons learned. *Software Process: Improvement and Practice*, Vol. 8, No.4, pp.267-281.

Ritala, P., and Almpanopoulou, A. (2017). In defense of 'eco'in innovation ecosystem. *Technovation*, Vols.60-61, 39-42.

Schein, E. H. (2008). Clinical inquiry/research. In P. Reason & H. Bradbury (Eds.), Handbook of action research. 2nd ed. pp. 266-279, Sage, London.

Schweitzer, F. M., Gassmann, O., and Gaubinger, K. (2011). Open innovation and its effectiveness to embrace turbulent environments, *International Journal of Innovation Management*, Vol.15, No.6, pp.1191-1207.

Seebode, D., Jeanrenaud, S. and Bessant, J. (2012). Managing innovation for sustainability, *R&D Management*, Vol. 42, No.3, pp. 195-206.

Surie, G. (2017). Creating the innovation ecosystem for renewable energy via social entrepreneurship: Insights from India. *Technological Forecasting and Social Change*. Vol.121, pp.184-195

Winter, J; Battisti, S; Burstrom, T. and Luukkainen, S. (2017). Exploring the success factors of mobile business ecosystems. *International Journal of Innovation and Technology Management*, In press.