

Holistic approach to innovation projects: the perspective of higher educational institutions

Elina GAILE-SARKANE

Faculty of Engineering Economics and Management, Riga Technical University
Riga, LV-1658, Latvia

Jean-Pierre SEGERS

Faculty of Engineering Economics and Management, Riga Technical University
Riga, LV-1658, Latvia
Faculty of Business Economics, Hasselt University
Hasselt, 3500, Belgium

Dirk V. FRANCO

UHasselt - Hasselt University, Centre for Environmental Sciences (CMK), 3590 Diepenbeek, Belgium
PXL, Central Administration, Building A, B-3500 Hasselt, Belgium.

Didier VAN CAILLIE

HEC Management School, Liège University
Liège, 4000, Belgium

Janaina MACKE

Graduate Program in Administration (PPGA), University of Caxias do Sul (UCS)
R. Francisco Getúlio Vargas, 1130
95.020-972 – Caxias do Sul (RS), Brazil

ABSTRACT

We are witnessing a shift of paradigms and changes in all aspects of economy, including the way of living and of managing businesses. It is well known that higher education is a national development function that aims to prepare talent and create added value for the economy. This is possible only by ensuring good cooperation between academia and industry which is possible through innovation projects. Today innovation moves towards holistic approach and the question of role and perspective of higher educational institutions in this changing environment becomes more and more topical.

Keywords: innovation, holistic approach, higher educational institutions

1. INTRODUCTION

We are witnessing a shift of paradigms and changes in all aspects of economy, including the way of living and of managing businesses. It is well known that higher education is a national development function that aims to prepare talent and create added value for the economy. This is possible only by ensuring good cooperation between academia and industry which is possible through innovation projects. The scope of Higher Education Institutions (HEI) has changed tremendously over recent times triggered by the COVID-19 pandemic (Witze, 2020) [15] and digitalization in our increasingly knowledge-based societies. Consequently, business models and innovative capacity of HEI are being challenged (Fig. 1) [1]. Today innovation moves towards holistic approach and the question of role and perspective of higher educational institutions in this changing environment becomes more and more topical.

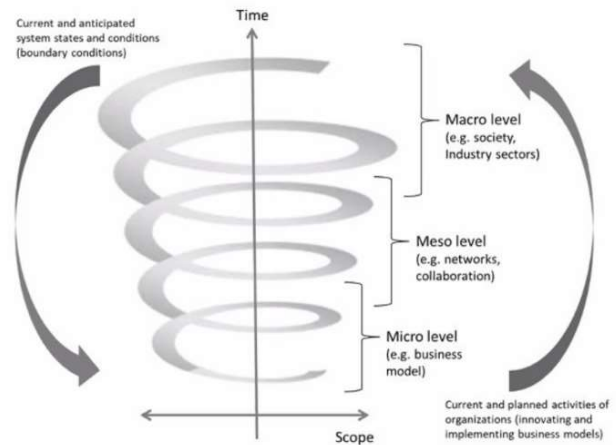


Fig. 1 – Scope of HEI (Aagaard, A., Lüdeke-Freund, F., Wells, P. (2021)) [1].

Higher education becomes smart, the traditional campus is transforming into a sustainable smart campus as universities are experimenting with the integration of new technologies and big data to improve how students live and learn on campus. As suggested by Culkin (2016) [3], entrepreneurial higher education institutions (HEIs) can act as ‘anchor institutions’, embedded within and committed to a region and regional development. In the entrepreneurial paradigm (Etzkowitz et al., 2000) [4], the entrepreneurial university plays an enhanced role in technological innovation. According to Schlegel et al. (2021) [9], HEI focusing on applied research are likely to co-operate with local industry in a triple helix model of academic–industry–government relations. This may contribute to positive innovation effects.

2. HOLISTIC INNOVATION

There are different innovation paradigms developed during the last 30 years. The simplest classification of paradigms is to group them into four or five categories, mainly based on geographical or cultural-based innovations. According to Chinese researchers Jin Chen, Ximing Yin, and Liang Mei, American scholars have developed user innovation, disruptive innovation, and open innovation. European scholars claim design-driven innovation and public innovation; Japan is well known for knowledge innovation. Korean scholars introduced the scientific community to imitation-based innovation (Chen et al, 2018) [2]. In light of the deficiency of existing innovation paradigms in the Chinese context and drawing from the advantages of Eastern philosophy and traditional Chinese culture, a new paradigm of innovation - Holistic Innovation (HI), which is total and collaborative innovation driven by a strategic vision in an era of strategic innovation, which aims for a sustainable and competitive advantage (Chen et al, 2018) [2]. As the authors Chen, Yin and Mei have mentioned – there are four main elements – strategic, total, open and collaborative. According to earlier research done by Manceau and Morand, an holistic view of innovation combines R&D and creativity and includes recent trends such as design thinking, open innovation, digitalization, sustainable development, and resource-limited innovation (Manceau and Morand, 2014) [7]. This – holistic approach is driven by different circumstances and trends – the multiple level perspective, lifelong learning, emerging new business models, sustainable development, helix approach, climate change, etc. Holistic approach to innovations is not uniqueness anymore, it is widely used approach which is highly expressed in higher educational institutions.

Today HEI is a part of large ecosystem, driven by cooperation with industry, government and peers globally which is widely described in scientific literature by triple, quadruple or even quintuple helix model.

3. METHODOLOGY

As higher education institutions have a national development function that aims to prepare talent and create added value for the economy, it is important to evaluate how holistic the university approach to innovation project are.

For this purpose, a group of international experts (researchers) decided to evaluate university strategies. As case study examples Riga Technical University (Latvia), PXL University of Applied Sciences and Arts (Belgium), Hasselt University (Belgium), University of Caxias Do Sul (UCS) (Brazil) and University of Liège (Belgium). Experts evaluated university strategies, main innovation indicators (outputs and outcomes of university-industry cooperation) and its correspondence to a new paradigm of innovation - Holistic Innovation (HI).

4. UNIVERISTY AS A CASE STUDY

Globally HEI are standing on three main pillars – education, research and cooperation with industry. These pillars could be fragmented and described in various ways, but it all results in innovation as one of HEI outputs. All three pillars are twisted together and in synergy creates added value to society.

Analysis of five HEI underlines holistic approach to innovation projects.

Riga Technical University

Riga Technical University (RTU) is accredited higher education

establishment and research organization of Latvia Republic. Its vision is to be a modern and prestigious university, internationally recognized as the leading university of science and innovations in the Baltic States – a cornerstone of the development of Latvia. It is one of the oldest institutions of higher technical education in Eastern Europe (established in 1862) and the largest technological university in the Baltic states. RTU is internationally recognized European university, striving towards high quality study process, excellence in research and sustainable valorization. It consists of 9 faculties which are united in 6 larger research platforms: Energy and Environment, Cities and Development, Information and Communication, Transport, Materials and Processes, Security and Defense. Approximate number of academic and research staff is 1 100. RTU offers exciting full-time and part-time studies to approximately 15 000 students, including 2 700 foreign students. It has its own engineering high school, demonstrating the leading position with learning results among state's secondary schools. During the last decade RTU particularly focused on strengthening the field of innovation and entrepreneurship. RTU is investing efforts in creating a modern innovation ecosystem and offering hands-on experience to the students, i.e. best global practices and models have been used to create RTU Design Factory. RTU Design Factory is not about teaching and bringing knowledge in a frontal way but rather learning through experience. RTU is recognized as being among 500 the best world higher education institutions operating in the field of engineering sciences and technologies by QS World University Rankings. It is the first prize winner in a competition for the best education institution organized among employers in Latvia and platinum category award in evaluation of Latvia's organizations' sustainability index.

For fostering, cooperation with industry, knowledge transfer and innovation development in 2016 RTU Design factory (member of Design Factory Global Network) was established. Within RTU Design factory in last 5 years (since 2017) cooperation with 121 companies were established, 104 start-ups were created, more than 15 000 people were involved in different activities of RTU Design Factory, more than 4 million euros were attracted within different projects, grants and donations.

PXL University of Applied Sciences

PXL University of Applied Sciences is part of a formal partnership with Hasselt University and within the newly established Syntra PXL, all acting as regional educational powerhouses in the entrepreneurial ecosystem. Together, they encompass 23 000 students. PXL offers associate degrees, professional bachelor, Master of Arts and life-long learning programs. Hasselt University offers master and doctoral programs. Both PXL and Hasselt University are fully accredited. The “*MiXed Learning model*” was introduced as a consequence of the COVID-19 outbreak, meaning many classes were shifted online, next to learning in class on campus and learning in/on the workplace.

PXL widely engages and co-creates with industry, non-profit organizations, government and civil society in a quadruple helix setting and holistic innovation approach. It serves to leverage the relevance and authenticity of high-quality programs and research projects but also to maximize the overall societal impact. PXL not only emphasizes the importance of synergy among education, research, and service to society in its vision, but also actively practices the latter by establishing strategic partnership networks and public-private partnerships. This way sourcing for and bringing in value through preferential industry partnerships. For this purpose, PXL is an active member of several regional

employers' organizations. This approach is translated amongst others in the creation of industrial advisory commissions for curriculum updates and renewals; in addition, PXL invites external representatives from the industry to co-chair the board of its study programs (UIIN, 2020) [13].

The different PXL research groups [8] such as 'Innovation and Entrepreneurship', "Educational Innovation", "Smart ICT", ... are linked to so-called learning network groups of the VOKA regional employer's organization. e.g. the smart cities network group. In 2020, the total revenue of PXL Research for 178 research projects increased by 12%, totaling 8,1 million euro. There was a growth of 25% in external financing.

There is an institutional commitment to entrepreneurship and sustainability (Segers, 2020) [11]. PXL and Hasselt University are founding partners of the StudentStartUP center of entrepreneurship (Franco et al., 2019) [5], working closely together with dedicated incubators in the region (Segers, 2019) [10]. PXL is an accredited SDG-Pioneer (UN, 2021) [14], acting as an engine of sustainable development, working in close cooperation with CIFAL- United Nations. By means of the SDG Wheel, PXL incorporates in a holistic manner the impact of new initiatives on the 17 sustainable development goals (SDG).

Hasselt University

Hasselt University is more than its seven faculties, four research institutes, three research centers, 6,500 students and 1,400 researchers and staff. As civic university we are strongly committed to the Region and the world (Hasselt University is the 15th Best Small University in the world). We want to make our society smarter, more agile, and better. Through education, research, and technology transfer. Hasselt University therefore attaches great importance to cooperation with other centers of expertise, companies, government agencies and organizations in Limburg and beyond. In addition to the quality assurance that takes place within Hasselt University is also monitored through the Flemish quality assurance system. This system is devised by the NVAO, in consultation with all stakeholders, to monitor the quality of higher education in Flanders. In its Research and Innovation Policy Plan Hasselt University these strategic objectives are striking (as the university covers the entire research spectrum: from fundamental research to valorization, and back)

- 1) Hasselt University endeavors to be an increasingly efficient, multidisciplinary research organization
- 2) Hasselt University opts for interdisciplinary research with socio-economic relevance.

In 1997, the existing environmental research of several UHasselt research groups was brought together under one roof, the Centre for Environmental Sciences, CMK [12].

The Centre for Environmental Sciences is striving to be an international academic leader in holistic, multi-, and transdisciplinary analyses pertaining to the environment, a source of robust science-driven advice to public and private decision-makers from the local to the international level, and an active promoter of academic and educational expertise in developed and developing countries.

The research income (basic and applied research together) increases with 49,83% (from 2015 to 2019), actual Ph.D from 533 up to 656 (from 2015 to 2019) (1140 ECOOM publications in 2019) and the Ph. D increases from 74/y up to 84/y (from 2015 to 2019).

The University of Caxias do Sul (UCS)

The University of Caxias do Sul (UCS), located in south Brazil, was created in 1967 by the community's collective effort, being

the oldest Higher Education Institution in the region. The mission of UCS is "to produce, systematize and share knowledge with quality and relevance for sustainable development", with innovation being a principle, guideline, and vocation for the University. The achievements in international and national rankings for evaluating Higher Education (Times Higher Education, Folha University Ranking and Entrepreneurial Universities) in 2019 and recent years result from this concept, which founded the emergence and essence of UCS and its commitment to social and human advancement. Innovation is the result of scientific research, it was with the investment in this eminently academic activity that UCS structured 19 *Stricto Sensu* Graduate Programs, which today offer 18 Master's and 10 Doctoral courses.

The University brings together more than 17 000 students, 736 academic personnel members, and 650 scholarship holders, permeating the entire academic structure and qualifying all levels of education. Added to the infrastructure of 800 laboratories on eight campuses, 92 of which are specific for research related to the provision of services or consultancy, this network of human and material resources constitutes the basis of the Science, Technology, and Innovation Park, TecnoUCS.

The philosophy focused on innovation is implemented from the base at UCS, with the application of a pedagogical model in undergraduate courses called Pedagogy of Innovation – INNOPEDA®, developed by the University of Applied Sciences of Turku, Finland. The purpose of this model is to provide methods and tools capable of implementing a process of learning innovation through the principles:

- 1) guidance for professional life
- 2) curriculum flexibility;
- 3) multidisciplinary;
- 4) active learning and teaching methodologies;
- 5) integration between studies and research and development activities;
- 6) versatile and development-oriented assessment;
- 7) renewal of the roles of teacher and student;
- 8) entrepreneurship and;
- 9) internationalization.

Liège University

As for Liège University (UL), it is an autonomous Public University financed by the French Community of Belgium. The University is a full University structured in 11 Faculties, 4 campuses in 3 different cities for 25 400 students involved in 207 Master Programs and supported by 5 700 staff members (academic, scientific and support staff).

Due to its high managerial complexity, the University has launched in 2013 a holistic, original and ambitious project, the University Risk Management initiative, that intends to integrate and to manage globally all the risks (from the most operational ones to the most strategic ones, integrating legal, educational, scientific, operational aspects) that are present daily or punctually inside and around the University. Research and innovation play a key role in this initiative and these two missions are supported by 2 complementary departments.

The research department operates as a staff department supporting fundamental research inside the University (financing, legal, HR, intellectual property essentially), while the mission of the Innovation Department is to foster and encourage the innovation process within the University and its eco-system. This mission is fulfilled by the setting up and animation of a very dynamic and complete eco-system turned towards creativity, innovation and entrepreneurship, within the Liège Science Park via Liège

Créative, Luxembourg Créative and other creative hubs, as well as via cross-border partnerships for innovation to detect, validate, mature and operate the transfer of technologies or knowledge towards the economic world according to the schemes of Open Innovation [6].

These transfer methods range from research in collaboration with companies to the creation of spin-off companies, through intellectual protection and the generation of licenses to companies.

It is obvious that all cases analyzed underlines higher educational institutions as a hub to development of holistic innovation projects due to their collaborative nature of universities which is driven by the strategic vision and aimed on development of a sustainable and competitive advantage.

To compare holistic innovation elements, the experts agreed that main parameters which should be taken from cases described above and included in the list of analyzed elements are: R&D, creativity, culture design thinking, open innovation, digitalization, sustainable development, strategic vision, sustainable and competitive advantage, long term orientation and uncertainty avoidance. For the measurement of the results method of visualization was applied.

Experts evaluated each parameter form cases applying symbols as it showed in the table No.1.

The analysis of university cases approves holistic approach to innovation projects, even more, it is a very good example to that show how holistic model for measuring sustainable performance generated by innovative projects could be created.

Table 1. Analysis of holistic elements of innovation projects in five universities

[symbols: ● – yes; ○ – no; ◐, ◑, ◒ - partly]

Holistic project elements	RTU	UL	PXL	UH	UCS
R&D	◐	●	◑	◐	◑
Creativity	◑	◑	◑	◐	◑
Culture	◐	◐	◐	◐	◒
Design thinking	◐	◒	◑	◐	◒
Open innovation	◑	●	◑	◐	◒
Digitalization	◐	◐	◐	◐	●
Sustainable development	●	◑	●	●	◑
Strategic vision	●	●	●	●	◒
Long term orientation	●	●	●	●	◑
Uncertainty avoidance	◐	●	◑	◐	◐

The case studies confirmed that universities are good players in national and regional ecosystems and provides a holistic approach to innovation. Universities are a source of creativity, develops culture, oriented towards design thinking, following global trends of digitalization, are sustainably oriented, all have clear strategic vision and long-term orientation as well as are able to avoid uncertainties.

5. CONCLUSIONS

What are perspectives of HEI and universities? Global changes have an impact on university development. Cases confirm that in HEI could not keep the traditional focus anymore, they are

transforming towards holistic approach to all of main pillars of HEI. Holistic approach in education is well known movement in education towards engaging all aspects of the learner, which is based on holistic learning theory. Holistic approach in research is based on study of complex systems in relations with other systems, and holistic approach to innovation projects allows to reach more and be more competitive.

6. REFERENCES

- [1] Aagaard, A., Lüdeke-Freund, F., Wells, P. (Eds.) (2021). Business Models for Sustainability Transitions. How Organisations contribute to Societal Transformation. Palgrave Macmillan.
- [2] Chen J., Yin X., Mei L., **Holistic Innovation: An Emerging Innovation Paradigm**. International Journal of Innovation Studies, 2(1), 2018, pp. 1-13.
- [3] Culkin, N. (2016). **Entrepreneurial universities in the region: the force awakens?** International Journal of Entrepreneurial Behavior & Research, 22(1), 4-16. Entrepreneurial universities in the region: the force awakens? | Emerald Insight
- [4] Etzkowitz, H., Webster, A., Gebhardt, C., Cantisano Terra, B.R. (2000). The future of the university and the university of the future : evolution of ivory tower to entrepreneurial paradigm. Research Policy, 29(2), 313-330. The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm - ScienceDirect
- [5] Franco, D., De Vocht, A. Kuppens, T., Martens, H., Thewys, T., Vanheusden, B., Schepers, M., Segers, J.P. (2019). **Sustainable Education: Essential Contributions to a ‘Quadruple Helix’ Interaction and Sustainable Paradigm Shift** in D.B. Zandvliet (Ed.), Culture and Environment: Weaving New Connections, Researching Environmental Learning, vol. 4, Leiden: Brill Publishers. Sustainable Education in: Culture and Environment (brill.com), 2019, pp. 367-393.
- [6] Kamto Kenmogne M., Van Caillie D. & Despy L., **Implementing an University Risk Management approach at the University of Liège: the lessons from year experiment**, EFMD 2016 Higher Education Research Conference, Barcelone, <http://hdl.handle.net/2268/207364>
- [7] Manceau D., Morand P. **A few arguments in favor of a holistic approach to innovation in economics and management**. Journal of Innovation Economics & Management, 3(15), 2014, pp. 101-115
- [8] PXL UAS International (pxl.be) and Research (pxl.be)
- [9] Schlegel, T., Pfister, C., Harhoff, D., Backes-Gellner, U. (2021). Innovation effects of universities of applied sciences: an assessment of regional heterogeneity. The Journal of Technology Transfer. DOI: <https://doi.org/10.1007/s10961-020-09839-w>
- [10] Segers, J.P. (2019). **The Emerging Entrepreneurial Ecosystem in the Limburg region, Belgium**. Amsterdam: University Industry Innovation Network. The Emerging Entrepreneurial Ecosystem in the Limburg region, Belgium - UIIN

[11] Segers, J.P. (2020). **Universities - Entrepreneurial and Sustainable. Best of Both Worlds?** [ACEEU | Spotlight Article](#)

[12] UHasselt [CMK - Centre for Environmental Sciences \(uhasselt.be\)](#)

[13] UIIN (2020). **Enhancing Quality in Higher and Continuing Education with and for SME.** In: Universities of Applied Sciences as regional powerhouses. Amsterdam: University Industry Innovation Magazine. [Magazine | Universities of Applied Sciences as Regional Powerhouses - January 2020 - UIIN](#)

[14] United Nations (2021). [Hogeschool PXL ziet SDG's als ideaal kader voor creatieve oplossingen \(unric.org\)](#)

[15] Witze, A. (2020). [Universities will never be the same after the coronavirus crisis \(nature.com\)](#), June.