ENTREPRENEURSHIP AND INNOVATION DEVELOPMENT AT HIGHER EDUCATION INSTITUTIONS: OPPORTUNITIES AND SOLUTIONS

Modris OZOLIŅŠ, Elīna GAILE-SARKANE, Enno ENCE, Evita ŠTRAUSA
Faculty of Engineering Economics and Management
Riga Technical University
6 Kalnciema str., Riga, LV-1048, Latvia

ABSTRACT

Abstract. Entrepreneurship plays an important role in the functioning of today's economy. Successful and fast-growing start-ups are major drivers for economic development and prosperity. Although it is true that inheritance is important to entrepreneurial abilities, the identification and development of entrepreneurial skills are not less important. In the last decade, universities have been given a special role in the development of entrepreneurial abilities. It is expected that, in parallel with the development of the specific skills and competences necessary for the profession, the educational institution will also ensure identification, assessment and development of entrepreneurial skills during the study process [2].
Scientific aim of the research is to study interdisciplinary teaching methodology for students' entrepreneurial and creative development and application of the same methodology for business. The same approach for creating a new product is used in the study process and in carrying out business needs (*MILZU!* case "Research and development of children's toy ecosystem in *MILZU!* cereal flakes packaging to increase the value added of food products", project no. 1.2.1.1/16/A/004). The new product development methodology under discussion is based on identification of customer values and needs followed by product development based on these values and needs.
Although the new product development methodology is based on the same ground, the application differs when used for studies or business purposes. The main differences are related to different motivation and interests of participants in the study process and business.

Keywords: Innovation Management, New Product Development, University-Industry Cooperation

1. INTRODUCTION

An interpretative research paradigm is used in the research that considers human activity as a social phenomenon that manifests itself in a particular social environment and context and is closely related to the researcher's interest in the research subject [1]. The study is based on the use of quantitative and qualitative methods in parallel. At the same time qualitative and quantitative data have been collected, aggregated and analysed in order to integrate research results into a comprehensive support model for the implementation of innovation projects.
Scientific aim is to evaluate an interdisciplinary teaching methodology for students' entrepreneurial and creative development at the university.
Subject of the research: methodology of teaching for development of students' entrepreneurship and creativity.
Objective of the study: testing of the methodology and its application within academia and beyond.

2. THEORETICAL BACKGROUND

Research of collaboration of the study process (university) and industry has always been a topical issue. The collaboration between university and industry is being studied based on the Triple Helix concept, published by Henry Etzkowitz in 1993, and then further developed in collaboration with Loyet Leydesdorff. The Triple Helix concept includes elements previously studied by Lowe, Sabato and Mackenzie (1982). Already in 1982, studies have highlighted the growing collaboration between university and industry in knowledge transfer. The Triple Helix concept refers to tripartite co-operation between higher education institutions, industry and the state with the aim of creating new institutional and social forms of cooperation for the development of production, transfer and use of knowledge. Over time, the concept has expanded to a Quadruple Helix, which also includes the civil society or even a five-figure spiral (Quintuple Helix, a concept that supports win-win situations between all parties involved - ecology, knowledge and innovation, while ensuring synergies in the economy, society and democracy) [6-10].
Research on university-industry collaborative models is also based on the main guidelines of the Italian-based scientist Giovanni Dosi. Dosi in his work emphasizes that technological innovation in the 19th and 20th century is a key factor contributing to economic growth in the countries. The process of creating innovations in enterprises can be described as a journey with attempts, mistakes and unexpected success. Enterprises are very heterogeneous in terms of size, productivity and profit margins. Namely, the enterprise parameters are asymmetric, but productivity and profit are fixed characteristics. The success of the country's successful development is

based on innovation by companies with locally "rooted" but globally related human capital [3; 4].
An important role in cooperation between universities and industry is business ecosystem at different levels, which mainly covers the social and economic environment that affects local or regional business. The business ecosystem has been talked about since the beginning of the 21st century, but one of the founders of the business ecosystem idea is Daniel Isenberg, who emphasizes the enormous importance of business environment (ecosystem) in business development, highlighting the significance of financial and human capital resources [12, 13].
At the end of the 20th century and at the beginning of the 21st century, cooperation between universities and industry has gained another viewpoint - it focuses on the implementation of student innovation projects by addressing practical problems of the industry and society, while ensuring the development of entrepreneurship and creativity. Based on global trends and topical European Union initiatives that characterize the future of Europe and the implementation of which mainly depends on the university, the transformation of higher education institutions is taking place: the study process and its implementation are constantly being improved, the university didactics change, the cooperation of the university and the industry is becoming more and more important [12].

3. METHODOLOGY OF THE RESEARCH

To achieve the aim of the paper theoretical and empiric research was done in two combined steps. Research period was January-May, 2017 for the theoretical and empirical research, and January – September, 2018 for testing of the methodology.
Within Systematic literature overview more than 60 different publications were analyzed for studying academia - industry – government interaction.
For triangulation purposes, focus groups and interviews of experts were organized. As a result of the forth step in this research, on the basis of the research results entrepreneurship developing teaching methodology was created.
On the second stage, entrepreneurship developing teaching methodology has been tested for academic process, as well as for business purposes. Similarities and differences for both applications have been identified.
In order to identify the interests and demands of stake holders (children, their parents) in-depth interviews have been conducted. In order to gain information for prototyping, four focus groups were conducted, involving more than 28 different persons as experts.

4. MARKET ANALYSIS AND DESCRIPTION

For cooperation between universities and industry and for the innovation projects implemented within mentioned cooperation two kind of objectives can be identified - academic and business objectives. It is not possible to ensure full implementation of both goals, however, yet they can approximated, as the objectives are complementary.
The initiative, which could ensure the promotion of students' innovations, development of entrepreneurship and creativity in higher education in Latvia, including co-operation mechanisms for attracting co-financing of companies and transfer of knowledge, motivation mechanisms for students, mutual cooperation between involved parties, reduction of administrative burden, is an important complex of concrete measures for development of Latvian business market.
Studying the practice of global universities, student innovation projects can be divided into three main groups according to the initiator and promoters of the project (UIIN web, 2016):
1. National / Municipal initiative projects (dominated in the Nordic countries, Israel, etc.).
2. Higher education initiative projects (dominated in Europe, Canada, Australia, etc.).
3. Industrial (corporate) project initiatives (dominated Europe).
The conceptual difference - which of the parties involved propose, plan, manage, co-ordinate and finance the cooperation. All student innovation project implementation models are essentially focused on common goals. Within the framework of the research, the experience of different universities and the existing interdisciplinary teaching methodology for students' entrepreneurial and creative development were summarized. The methodologies used at the University of Aalto in Finland, the University of Regina in Canada, the Massachusetts Institute of Technology, the Georgia Institute of Technology and elsewhere were analysed. The study concluded that training methodologies for developing entrepreneurial activity are similar, the main differences are related to:

- the infrastructure available to the university;
- the resources at the university's disposal (including human resources);
- ecosystems.

Entrepreneurship developing teaching methodologies are adapted to a particular situation.

5. RIGA TECHNICAL UNIVERSITY EXPERIENCE

In Riga Technical University *(RTU)*, in separate study programs, Entrepreneurship development teaching methodology has been used since 2002. In order to develop entrepreneurship at all levels and fields of study, systematizing and deepening knowledge in the development of new products, technology transfer, innovations and their

commercialization, as well as business issues, a unified study methodology was developed in 2016 when its gradual introduction started. Innovative and interdisciplinary methodology-based study course "Innovative Product Development and Entrepreneurship" with the ultimate goal - to allow the widest possible range of students to use the acquired knowledge, skills and methods in work situations and in their professional development, starting a business and setting up their own companies, was tested and approbated.

This course is based on a similar global best practice, e.g. Massachusetts Institute of Technology, USA; TU Delft, the Netherlands, and on more than fifteen years cooperation experience between *RTU* and the University of South-Eastern Norway, jointly implementing study course "New Product Design and Development" in the Latvian-Norwegian Master's program "Innovation and Entrepreneurship".

Unlike other study courses, a project-based learning approach is actually used in the course implementation process. The pedagogical and psychological issues of project-based learning have been studied by Helle, et al [11]. Project based approach provides opportunities for holistic development of different competences, also providing interdisciplinarity. At the same time, innovative projects for industry and society are being developed within the framework of these projects, thus they can be classified / described as student innovation projects implemented within the Triple Helix model of cooperation between the university and industry.

6. *MILZU!* CASE RESEARCH PROCESS AND RESULTS

As already mentioned, the same methodology for creating a new product can be used both in the study process, in research and in the realization of business interests. This methodology is based on customer needs analysis and product development based on these needs. The original methodology was developed for student training by Eppinger, Fine, Ulrich [5].

The Ulrich & Eppinger methodology has been used in RTU student training since 2003. For the first time in the framework of this project the methodology was applied to *MILZU!* business project, its aim is to create a constructor system based on the identification of consumer needs, which includes the possibility to provide a "movement" for the toy through educating the user about green energy, electronics and mechanics, as well as promoting creative and green thinking. Experts from business, academia *(RTU)* and *RTU* students were involved in project implementation.

Within the framework of the project, the following tasks were implemented:

1. Research on the products available on the market.
2. Generation of ideas needed for a new product, with three to five most promising solutions.
3. Sketchbook and / or simplified prototype for demonstration and testing ideas created
4. Prototypes that are as close as possible to serially manufactured were created.

Successful implementation of the assignments was possible due to close cooperation between the stakeholders based on the accumulated expertise of each stakeholder.

Within the framework of the joint business – academia (*MILZU! – RTU*) study, a complex of activities was conducted in order to achieve results of the research. Unique competences of *RTU* Design Factory experts in identifying customer needs and developing new products were applied.

To develop prototypes, focus groups for stakeholders were organized in January, 2018, so that the accordance of results with needs, values and interests would be confirmed. The focus groups were hosted and co-managed by *RTU* Design Factory.

Guidelines	Women	Children
Values	Family and children Health Welfare Love, peace, harmony	Family Love Friendship
	Qualities: Honesty and responsibility Helpfulness Security Harmony with nature	
Interests	*Women support children's interests:* Sport. Creativity, arts. Cognitive activities.	Friends and playing. Virtual environment. Sports. Learning, cognition. Creative activities. Surprise and adventure.

Figure 1: *Values and interests of women and children (authors' developed framework)*

Based on a study about women's values (determination of typology of values: adapted test version, S.H.Schwartz [14]), priorities and interests of stake holders (10 respondents – women in age group 25-34, with children) a study, using quantitative survey (78 respondents – women in age group 20-45), was conducted. Interviews within children were held, the total amount of respondents were 34 in age group 7-13. As a result of practical research, guidelines were proposed which are basis for *MILZU!* products' value added. Values and interests can be seen in Figure 1.

Taking into account results of interviews and focus groups within children stakeholders (interviews

mentioned above and 2 focus groups: 11 boys in age group 9-12 and 10 girls in age group 9-12), it was ascertained that particularly constructor most accurately meets the needs, values and characteristics of toys which are expected by stakeholders as value added of product. The evaluation of the constructor elements' prototypes generated within the study provided feedback on the interests, needs and values of the stakeholders (19 interviews with children in age group 7-13 and 10 interviews with women in age group 25-38).
Constructor system's description includes playground environmental objects, functional elements, details for toy making, characters, thematic series, option to complement the toy set, improvise.

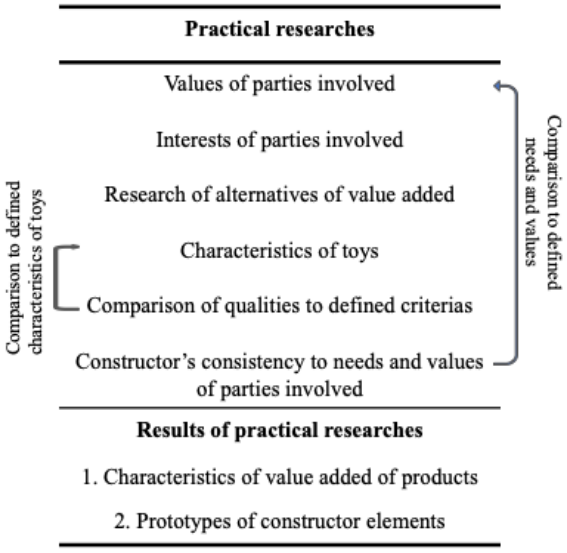

Figure 2: *Process of practical research (authors' developed framework)*

Constructor system includes variations of different levels for diverse stakeholders (gender, age, topics of interest, accessory options). It is intended to form the constructor system from separate elements, putting them in parts as product's value added.
Comparing results during the empiric research previously defined theoretical concepts were approved and results were compared in different stages of research in order to verify whether the final results correlate with results of tests, interviews and surveys. Constructor system's practical research activities can be seen in Figure 2. In the process of new product development, the comparison was repeated: to develop prototypes according to needs, values and defined characteristics of the toys.
In order to compare differences in the application of the Ulrich & Eppinger methodology in the educational process and in business, expert interviews were conducted, resulting in a series of differences identified (Table 1).

Table 1
Methodology comparison (authors' developed framework)

Indicator	Application of the methodology for study process	Application of the methodology for business
Source for needs identification	Different	Business driven
Total length of the process	16...24 weeks	Approx. 2 years (depending on the product)
Result of the process	Prototype	Launch of the new product into business
Major stakeholders interested in the result	Students	Business
Motivation	Average (grade)	High (money)
The nature of product creation and development process	Single, mostly linear	Multiple, circular, with the highest possible degree of development in the reproduction cycle
Involvement	Average	High
Recouces available and involved	Limited	Medium - high

As can be seen, the parameters of the application of the methodology may differ, especially the differences in the nature of the product development process, the involvement of resources and the result. In business successful result is a new product in production.

7. CONCLUSIONS

Ulrich & Eppinger's methodology based on customer needs identification is different when used for studies or business purposes. The main differences are related to different motivation and interests in the study process and business.
The use of methodologies in business showed a more long-term, circular result, while the methodologies used in the study process showed a linear process of product creation and development with beginning and end. However, the very essence and application of the methodology ensures the implementation of both academic and business interests. In addition, if the methodology is well learned during the course of studies and recognized as good, it will be used more often and effectively for business purposes.
Student innovation projects are a way of integrating study and business goals, thus leading to a more valuable outcome for the various stakeholders involved in the process.
At the same time, student engagement in a business environment is being developed, which gives both sides exchange of competence, as well as adds focus on the compliance of the developed product with the

demand of the target audience and commercialization opportunities.

The particular *MILZU!* case confirmed the important cooperation role of the academy *(RTU)* and business (*MILZU!)* partners in achieving the best possible results.

Acknowledgement

In accordance with the contract No. 1.2.1.1/16/A/004 between the Latvian food competence centre Ltd. and the Central Finance and Contracting Agency, concluded on 11th of October, 2016, the study is conducted by the *MILZU!* Ltd with support from the European Regional Development Fund within the framework of the project "Latvian Food Industry Competence Centre".

6. REFERENCES

[1] Cohen, L. (2007). Research Methods in Education / Cohen, L., Manion, L., Morrison, K., 6th Edition – Routledge.

[2] Communication from the Commission to the European Parliament, the Council, the European Economic and social Committee and the Committee of the Regions, (2012). Entrepreneurship 2020 Action Plan, Reigniting the Entrepreneurial Spirit in Europe, Brussels. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52012DC0795

[3] Dosi, G. (1994). The Process of Economic Development: Introducing Some Stylized Facts and Theories on Technologies, Firms and Institutions / Dosi, G., Freeman, C., Fabiani, S., Industrial and Corporate Change, 3(1).

[4] Dosi, G. (2005). Statistical regularities in the Evolution of Industries. A Guide through some Evidence and Challenges for the Theory, LEM Working Paper Series, No. 2005/17.

[5] Eppinger, S.D. (1990). Interdisciplinary Product Design Education / Eppinger, S.D., Fine, C., Ulrich, K.T., IEEE Transactions on Engineering Management, Massachusetts Institute of Technology.

[6] Etzkowitz, H. (2007). The Coming Gender Revolution in Science / Fuchs, S., Gupta, N., Kemelgor, C., Ranga, M., In: E. J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (eds) New Handbook of Science and Technology Studies (3rd edition), Cambridge: MIT Press.

[7] Etzkowitz, H. (2010). Picking Winners. Revisited: Government's Role in Innovation during an Economic Crisis. In: E. Lennart and J. Leijten (eds), New economic ground for innovation policy, Cultiva Comunicacion SL.

[8] Etzkowitz, H., Leidesdorfu (Leydesdorff). Retrieved from: http://triplehelix.stanford.edu/3helix_concept.

[9] Etzkowitz, H. (2010). The Road to Recovery: Investing in Innovation for Knowledge-Based Growth / Etzkowitz, H., Ranga M., In: P. Ahrweiler (ed.), Innovation in complex social systems. London: Routledge.

[10] Etzkowitz, H. (2011). A Triple Helix Governance Strategy for Regional Innovation / Etzkowitz, H., Ranga M., In: A. Rickne, S. Laestadius and H. Etzkowitz (eds), Innovation Governance in an Open Economy: Shaping Regional Nodes in a Globalized World, London: Routledge.

[11] Helle, L., Tynjälä, P. & Olkinuora, E. Project-Based Learning in Post-Secondary Education – Theory, Practice and Rubber Sling Shots. Higher Education (2006) 51: 287-314.

[12] Isenberg, D. (2010). How to Start an Entrepreneurial Revolution, Harvard Business Review.
Retrieved from:
https://institute.coop/sites/default/files/resources/Isenberg%20-%20How%20to%20Start%20an%20Entrepreneurial%20Revolution.pdf

[13] Isenberg, D. (2014). What an Entrepreneurship Ecosystem Actually Is. Harvard Business Review, 88(6), 40–50.

[14] Schwartz, S.H. (2006). Value orientations: Measurement, antecedents and consequences across nations. In Jowell, R. & Roberts, C. & Fitzgerald R. & Eve G. (eds.), Measuring attitudes cross-nationally - lessons from the European Social Survey. London: Sage.