OPEN INNOVATION AND THE INNOVATIVE ENTREPRENEURIAL SPIRIT IN THE MODERN UNIVERSITY

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Abstract

Open innovation is based on a multitude of mechanisms that we also find in the university space, namely knowledge, skills, experiential learning that become operational at the individual, company and society level. Exploring the challenges faced by the modern university in the development of the entrepreneurial ecosystem, through the study of the practices of the University of Pitesti, we highlighted the incremental nature of the development of the innovative and entrepreneurial student ecosystem. The development of the experiential learning activity through the simulated company represents an important step in cultivating the innovative spirit and the entrepreneurial ecosystem in the university. The case study presented in the paper illustrates how the entrepreneurial education of students can be combined with the innovative entrepreneurial spirit in an innovative and collaborative ecosystem.

Keywords: *open innovation, innovative entrepreneurship, entrepreneurial ecosystem, open innovation competence*

JEL Classification*: A23, M11, O21*

Introduction

In the current context, the modern university contributes to the development of young people's skills required by the labor market through the creation and transmission of knowledge, but also through the effort to build experiential learning contexts that provide young people with the opportunity to simulate, to experience actions, processes through which value creativity and cultivate the entrepreneurial spirit. The development of innovative ideas is the result of implementation of ***innovative entrepreneurship.*** Innovation and entrepreneurship are variables that lead to the achievement of the competitive advantage of the modern organization. These aspects have been the subject of studies since the time of Adam Smith. Joseph Schumpeter speaks in his work "Theory of Economic Development" about the entrepreneur as an innovator, and entrepreneurship is called by Schumpeter "the storm of creative destruction" because through thought-out business models it sets the economy in motion.

The socio-economic environment calls for a new concept of a university, an innovative university that implies a change in the way of using students' creativity, informational and material resources for a good positioning of students in the value chain of the entrepreneurial ecosystem. The success of students' entrepreneurial behavior can be built and ensured through the new concept ***the entrepreneurial ecosystem***. Wurth, B s.a (2022) believes that the entrepreneurial ecosystem can be approached as the result of the connection between entrepreneurial context, high growth entrepreneurship, clusters, regional innovation systems, entrepreneurial environments and business ecosystems.

Ruben H.A.J. Ogink s.a (2022, p.) highlighted the breadth of the concept of open innovation developed in the fundamental book of Chesbrough (2003). Open innovation has become an umbrella term for all innovation activities that includes, among others, capitalizing on the discoveries of others, collaborating with third parties in research and development projects. An increasingly important place within the entrepreneurial ecosystem is currently

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given to the concept of **open innovation**. **Open innovation competence** can be captured using a profile with the dimensions of creativity, entrepreneurship, communication and networking, open-minded thinking, risk-taking, and self-efficacy in digital skills (McPhillips, M.; s.a.,2022)

Dimensions of OI Competence are described of European Skills, Competences, Qualifications, and Occupations (ESCO) and McPhillips. s. a as such (2022, p.8):

- ✓ Creativity-generating new ideas or combining existing ones to develop innovative solutions
- ✓ Communication and Networking-communicating, liaising, collaborating, and negotiating with other people, developing solutions to problems, organizing and managing a business venture, identifying and pursuing opportunities and mobilizing
- ✓ Entrepreneurship-resources, keeping in mind a profitability perspective; demonstrating a proactive attitude and determination to achieve success in business
- ✓ Open-minded thinking -being interested and open to the problems of others
- ✓ Risk-taking attitude accepting responsibilities for managing activities and adopting a forward-looking approach to anticipate problems, but also identifying opportunities
- ✓ Self-efficacy in digital skills using digital tools for collaboration, content creation, and problem-solving".

In the academic community, concepts and tools have been developed to value the creativity of young people and the expertise of teaching staff and the business environment. Such examples are social innovation, experiential learning, and simulated firm.

In higher education in Romania, innovative entrepreneurial education is a less structured approach than in other countries in the European Union, although many Romanian universities have adopted different initiatives in this regard. Statistics at the European level indicate that Romania gives little importance to entrepreneurial education, so that less than 10% of those who have initiated and developed a business have a theoretical basis in this regard, compared to the European average of 30%. According to the Guide "Strengthening the entrepreneurial spirit and skills in the EU" developed by the European Commission, the trajectory of the EU policy demonstrates the fact that entrepreneurship education, as it is currently articulated in policies and used in practice, has the potential to generate a series of positive effects on economic and social development.

The simulated firm develops the concept of **social innovation** and emphasizes methods that allow students to develop entrepreneurial and transversal skills through active learning (*learning by doing*) in an experiential learning context. Students are supported to understand the process of establishing a firm and the contacts they must establish for this purpose with state institutions, to organize and plan their own activities, to develop innovative product concepts, to integrate into a work team, to come into contact with the industrial and socio-economic environment, to be creative and to develop their communication skills, thus increasing their chances of integration on the labor market or in the business environment. Through this method of social innovation, the development of the next set of skills and competencies for "employed" students is pursued: understanding the business environment; the ability to identify market opportunities and the ability to take advantage of them, understanding entrepreneurial ethics, understanding the process and procedures related to setting up a business, identifying and evaluating strengths and weaknesses; risk assessment; planning and project management; applying the principles of efficient financial management; understanding a business and how it works; the development of synthetic thinking (the ability to structure, synthesize); the development of analytical thinking (the ability to analyze a

phenomenon); the development of critical thinking (the ability to formulate and present critical points of view); the development of creative thinking, the ability to negotiate and represent; the ability to establish and develop relationships; the ability to work in a team, the ability to communicate, the ability to make one's point of view understood by others, the ability to prepare activity reports, the ability to coordinate activities, the ability to effectively manage working time etc. Thus, a high importance is given to the development of transversal skills (*soft skills*) considered more and more important on the labor market and in business. The simulation of the processes and activities carried out by the student in the simulated firm is carried out under the coordination and mentoring of the teaching staff and representatives of the business environment and through the implementation of participatory management.

The activities carried out by the students "employed" within the simulated firm are: identification of needs and/or problems at the market level; generation and selection of innovative product/service ideas; analysis of the solutions currently offered on the respective markets (competition analysis); identifying alternatives to offer solutions in the form of products and/or services that cover certain specific needs at a higher level - the use of alternative sources and methods for generating ideas/solutions; establishing the functions of the product and the technical and economic dimensioning of the functions; the systemic analysis of functions and the establishment of research directions, the finalization of the preliminary conception of the product, the materialization of the concept (complete technical description as well as the final structure of the product in terms of shapes and sizes); developing product concepts and testing the respective concepts (viability, from an economic point of view, from a market point of view, from a technical point of view) etc.

The innovation process in a simulated firm - from idea to implementation

The concept of social innovation as a component of the innovative entrepreneurial ecosystem of the modern university can be implemented using the experiential learning method of the simulated firm type. Within it, you can experience the innovation process from idea to implementation by going through all the steps related to the organization and simulation of the way a firm operates. One of the experiments carried out within the University of Pitesti is Î.S. Students Innovative Corporation S.R.L., in the field of assembling electronic products, simulated firm with 8 "employees" students from the Electronics and Computers study program.

The firm’s activity took place within the university entrepreneurial ecosystem made up of coordinating teaching staff, mentors from the business environment such as entrepreneurship advisors, experts from various organizations with a profile similar to the simulated firm, teaching staff with entrepreneurial training.

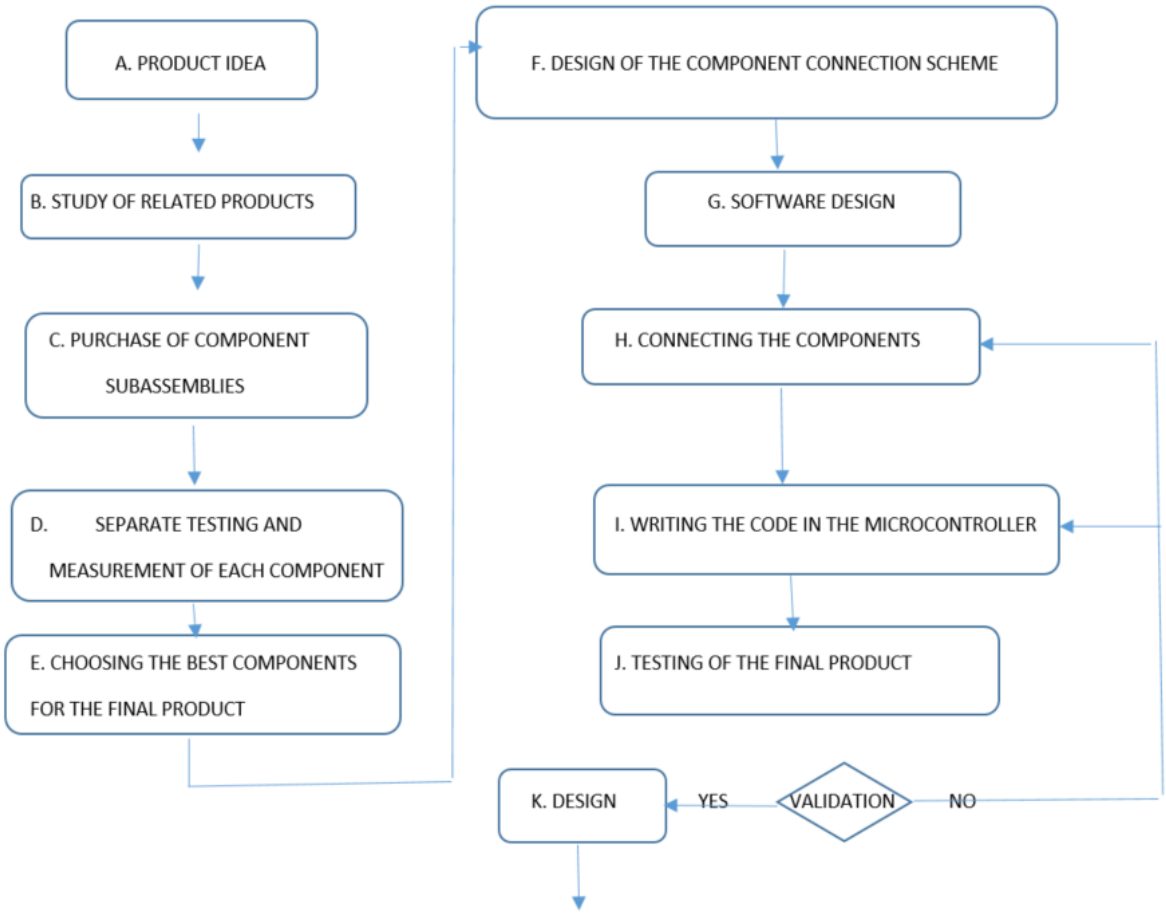
The operationalization of the simulated firm began with the recruitment process of future employees for the 8 positions in the firm’s organization chart, respectively: manager of the simulated firm who has under him a research-design project coordinator and a testing, production, quality assurance coordinator. Each coordinator had under his command a design and programming team made up of 3 computer-aided research-design specialists and an assembly and testing team made up of an electronic engineer and a quality engineer.

After this, *the idea generation process* followed by identifying existing products on the market that each of the employees of the simulated firm believed could be improved, either in terms of price or in terms of functionality. Most of the ideas identified came from the students' personal areas of interest. The involvement of the entire team in the effort to identify ideas and then to select the best ideas was specially followed.

The next stage was the implementation of the ideas based on the organizational chart of the process of transition from idea to product presented in figure no. 1. Immediately after the idea generation stage (Figure 1 – A), it followed a study stage of all existing products

on the market conceptually related to the products selected by the firm's employees (Figure 1 – B). Only the examples with the cheapest technology, namely Arduino, were chosen. For a short-term project, a technology with a quick learning curve was needed and Arduino technology is the best fit in this case. The products generated by the firm must compete precisely in this market segment, where the competition is high due to the accessibility and spread of this technology among electronics (even amateurs). Related products on the market were analyzed and broken down into subassemblies and components and a list of subassemblies needed for each individual idea was made. For each sub-assembly from which a product was to be assembled, the cheapest electronic components on the Romanian market were sought. For some of these, several component variants were ordered (Fig. 1 – C), with the aim of subjecting them to measurements (Fig. 1 – D) and establish the conclusion regarding the right choice. (Fig. 1 – E). After choosing the best components, we moved to the hardware design stage (Fig. 1 – F), which schematically describes how the component subassemblies will be coupled and integrated into a final product. The next stage, software design (Fig. 1 – G) is the stage where a small firm can bring the most innovation in future product functionality. Currently, most innovations are not at the hardware level, but at the level of software applications. After establishing the functionalities that the product can have, on the logic diagram resulting from the software design stage (Fig. 1 - G), we proceed to the stage of assembling the components (Fig. 1 - H) and programming the Arduino microcontroller (Fig. 1 - I) which is the brain of the whole device. After writing the code, respecting the requirements imposed by the logic diagram previously established in the software design stage, the final device is tested (Fig. 1 – J). If, after testing, problems are encountered at the hardware level, a return is made to the stage of connecting the components, and if problems are found at the level of the code written in the microcontroller, it is returned to its programming (Fig. 1). After several iterations at the level of this last loop, after the correction of all the errors and problems encountered, the product is finally sent to the design stage of the case that will dress it (Fig. 1 – K). This is where the work of the simulated enterprise in this project stopped, although of course one can imagine how after the design stage one can proceed to the stage of 3D printing the casing and re-testing the integrated product in this new form. Then there is another winding road to mass production and market launch which of course are not the subject of this study. The tasks of generating ideas (Fig. 3 – A) and designing the final product cases (Fig. 1 – K) were shared by all employees. However, the other tasks were specific to each work team, according to the job description of each employee.

Flowchart of the process of transition from idea to product



The final products obtained in the social innovation process are those in table no. 1.

Table no. 1

The products of the firm I.S. Students Innovative Corporation S.R.L.

No. crt.	Product	Existing specifications on the market from the competition	Innovations implemented
1	Electronic cane for the blind people	Vocally notifies the user about objects existing in front of them	Tactile information from all directions, mounting a wheel
2	Mini weather station	Temperature, humidity, wind, precipitation sensors	Graph of weather parameters evolution over time, UV measurement
3	Anti-Covid dispenser	Disinfects without contact	Low cost, PET recycling, customized case according to the beneficiary
4	Automatic animal feeder	Automatically feed pets at preset times	Cost reduction, More attractive case Feeding at predetermined intervals
5	Plant humidifier	Detects soil drying Water the plants automatically	Different programs for different plants
6	Student's watch	LCD display of a classic watch	Programming homework alarms for students on the clock
7	Pulse oximeter	It measures the pulse It measures oxygen saturation	Cost reduction The speed of measurements

To exemplify the innovation process, we will next present 3 of the 7 improved products that were the object of the activity of the students employed at I.S. Students Innovative Corporation S.R.L. Innovation was used as an incremental process, which involves incremental improvements starting from already existing things. The innovation process consisted in identifying the problems with existing products on the market taken as reference points that directed the firm towards innovative solutions.

1. Electronic cane for the blind people is one of the most innovative products developed by the simulated firm as there are few models on the market that serve the needs of people with vision problems. Compared to the product identified in the market, the student employees of the simulated firm made many changes in the electrical diagrams taken as a model from the Internet ([1] Arduino based Smart stick for blinds, September 2018, https://create.arduino.cc/projecthub/Creatjet3D-Labs/arduino-based-smart-stick-for-blinds-3db0ad and [2] Voice Alert based Smart Blind Stick Using Arduino Nano and Ultrasonic Sensors, May 2021, https://circuitdigest.com/microcontroller-projects/voice-alert-based-smart-blind-stick-using-arduino-and-ultrasonic-sensor).

On the organizational chart of the process of transition from idea to product (Fig. 1) these hardware changes were made at the level of stage F (Fig. 1 – F). The hardware changes required radical changes on the software side as well (Fig. 1 – G).

Mini weather station which can be used both locally, to read ambient parameters in the home or office, and remotely, using Wi-Fi technology. For the time being, the simulated firm could only develop the local version, but in the future the transition to online data transmission is not difficult, if the Arduino is replaced with an ESP. There are a few Arduino-based weather stations online, and the one the firm wanted to improve on is a variant that, being inexpensive, can be installed by a person on a low income even in every room of the house (Weather Station https://create.arduino.cc/projecthub/pcimule/weather-station-general-detail-screen-0a96a2). The reference product could only measure temperature and humidity and calculate the thermal comfort index based on them. The simulated firm additionally added 2 new facilities while maintaining the same price of the final product, namely the simulated firm added a UV radiation sensor at the hardware level, and allocated (software) a rectangular area on the screen in which this level is displayed.

3. ***Anti-Covid dispenser,*** an innovative product created by the simulated firm starting from a model created also based on Arduino (Touchless Disinfectant Sprayer https://create.arduino.cc/projecthub/FiDeNet/touchless-disinfectant-sprayer-ae10b6). The new product improvement ideas focused especially on the materials used to reduce the price of the dispenser. It is intended to be cheap enough to be widely available in all classrooms of educational institutions. The basic electronic components (Arduino, sensor, relay and pump) cost under 50 lei, and the tank was improvised from a 0.5 liter water PET, thus being able to reuse the water PETs to create disinfectant tanks.

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