SYNTHETIC MODELS OF UNIVERSITY INDUSTRY COOPERATION CASE STUDIES ON R&D AND START-UP SCHOOL

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Currently there is a number of existing and reasonably well defined schemes for collaboration between universities and the industry. Some of the most well-known models are A1 (Department as a nest of developers), A2 (Department as a center for certification support), B (Department as a center of joint R&D) and C (Department as a business incubator). The Ukrainian-German-Canadian educational initiative "International R&D and Start-Up School" created at National Odessa Polytechnic University implemented a synthetic model that aims to rectify some of the shortcomings of the already existing approaches while employing their strong suits.

Keywords: International Involvements of Universities, IT- Education, University-Industry Cooperation, Start-Up School, Synthetic Models

Introduction: In order to better prepare IT specialists at a specific university, one requires, in addition to solid fundamental knowledge and skills, to be able to grant the students the ability to hone their team working skills in international and diverse teams and experience working in the R&D sector, tailored towards the demands of the market. These aspects should be complemented by a set of basic entrepreneurial skills and concepts [3]. The Ukrainian-German-Canadian educational initiative "International R&D and Start-Up School" created at National Odessa Polytechnic University with precisely this purpose in mind, implements and employs the Synthetic Model of University-Industry Cooperation, as described below.

The goals: The most important goals of this initiative are to prepare highly skilled specialists in specific fields in collaboration with international teams and companies. As well as to be able to produce a real prototype or product for the customer or for the company that needs to validate their concept. Doing so will provide research and development opportunities for small and middle sized businesses and therefore further stimulate the collaboration and growth of both parties.

The Implementation and Discussion: Currently there is a number of existing and reasonably well defined schemes for collaboration between universities and the industry. Some of the most well-known models are A1 (Department as a nest of developers), A2 (Department as a center for certification support), B (Department as a center of joint R&D) and C (Department as a business incubator) [1].

The model proposed in this work is a kind of synthetic model that combines within itself the advantages of a number of models discussed above at once. It is also the next stage of development for the aforementioned models, as it is more sustainable.

The National Odessa Polytechnic University and its partners (University of Applied Sciences (AUAS) (Augsburg, Germany), Berlin University of Technology and Economics (Berlin, Germany), University for Applied Sciences (Erfurt, Germany)) employ this model within the scope of the International R&D and Start-Up School created as a joint initiative.

The structure of the school can be seen in Figure 1 below.

As can be seen in the diagram, the school is managed by the board of the school with the director as the head. The members of the board are the German and Ukrainian professors who represent each of the partner universities and are responsible for the joint collaboration. The mentors represented by the industry partners, and consist of engineers and other specialists who are directly involved in the engineering and design processes. These members are also responsible for various directions of research and development. The Team Leader group consists of the most experienced and

Fig. 1 - The Structure of the School

talented members of all the teams. These individuals, as a rule, lead a project or a group of projects as well as their corresponding team. Where the teams themselves consist of domestic and international students, who are involved in the processes of research, development and education.

A number of rather evident ideas were placed as the foundation for the concept of the school. Implementation of new and innovative projects at Start-Up School becomes possible, due to the effective collaboration between the university as the base organization, its international partners and specialists from the industry that act as mentors and representatives of the businesses. A representative diagram of this collaboration can be seen in Figure 2 below.
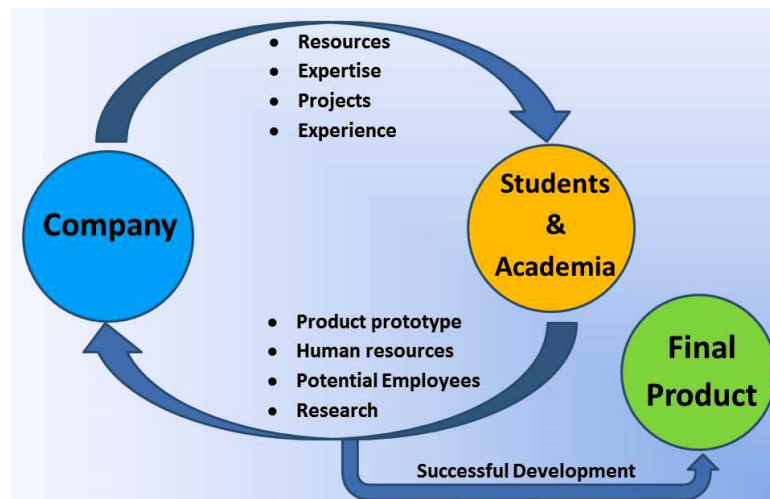

Fig. 2 - The Industry Cooperation Ecosystem

On one hand, the company provides the topic for the project as well as the necessary resources for its implementation and an experienced mentor who has expertise in the area of project topic.

On the other hand the School and universities provide the ongoing research and development, within the scope of the program, human resources as well as academic support.

As a result of such collaboration one could obtain either a working prototype, a proof of concept or a finished product [2]. Our experience has shown that to a certain degree most progressive universities strive to use R&D as part of the curriculum in order to prepare engineering specialists. In our case, the ideas for the projects are usually supplied by the industry partners, who also act as the technical consultants for the said projects.

Therefore, the projects that are implemented within the School are usually chosen to be within the scope of some technological trend and, as a rule, have the potential to become an independent business venture.

In order to make this initiative vital and sustainable, an approach which can be characterized as a win-win-win strategy is applied. It benefits every party involved in the process, the students, the universities and the industry partners.

During their education all of the students get real work experience over the course of their work on the project. All of the participants obtain the necessary access to networking and connection opportunities within the academic and industry communities of their field of interest.

These factors cause the quality level of the students to dramatically increase due to the fact that the students improve their level of competency through real-world industrial projects, and therefore obtain relevant and currently sought after skills [4].

Universities will also get to expand their network as they will be receiving additional international exposure and be involved in more collaboration initiatives with other parties.

In addition the research topics that the university pursues become more relevant and closer to the real industry needs and trends. This change will in turn results in the potential of receiving funding and grant opportunities increasing.

But one of the most important benefactors and stakeholders of this collaboration, the industry, also receive their dividends from the process. First of all, the involved partners will receive a sustainable pool of verified potential employees, and will therefore be able to easily obtain qualified specialists in their area of interest. In addition, for a minor investment they could validate some interesting concepts, that they would otherwise not have the time or resources to explore. And at lastly they would have the possibility to get a functioning Product or a concept prototype of their design.

The research at the school is currently pursuing the following directions:

- Microcontrollers and Wearable Devices
- Web applications
- Mobile applications
- Alternative and Green Energy Technology
- Sensors and Microcontrollers
- Internet of Things

Some of the more prospective projects that have been recently implemented are:

- Smart Sensor Network Based on a Cloud computing Client service (Web applications and Cloud Computing);
- Smart Sensor Network System with POE Capabilities that we made for managing and monitoring smart buildings. This system was developed in collaboration with Cisco systems.
- Universal Gateway for Indiscriminate Telemetry Data Routing and Processing (Microcontrollers and Wearable devices). This universal gateway was designed to provide a connection and wirelessly channel data between a Pebble smartwatch and a variety of data sources with different communication protocols, data formats and mediums of data transmission.
- Structured Interview Architecture: A flexible mobile software approach to assist interviewers and workers in related fields in conducting consistent and well documented interviews (Internet of Things). A project that was done in collaboration with the psychology department at University of British Columbia, where an adaptable system was developed via a flexible, mobile application based, software approach was used in order to assist child psychologists and social workers with in conducting consistent and well documented child interviews, while granting the ability of simple modification in order to adjust to new developments in approaches and protocols.
- Green Campus (Alternative and green energy, Sensors and microcontrollers). Within the scope of this project a system was designed that enabled monitoring and optimization of energy consumption by using a distributed sensor system and energy consumption control sequences. As a result of the project, the anticipated decrease of energy consumption on the trial campus, by utilizing a combination of varying tariffs as well as use of renewable energy sources, is expected to be 50%.

Conclusion: The abovementioned approach allows to apply the concept of **3-Win strategy**, a system of relationships where each of the participants, universities, students and companies, receives a "Win".

The three aforementioned wins can be summed up to the following pints for each of the parties:

- **The students:** During their education all of the students get real work experience over the course of their work on the project. All of the participants obtain the necessary access to networking and connection opportunities within the academic and industry communities of their field of interest.

- **The universities:** The approach will cause the quality level of the students to dramatically increase due to the fact that the students improve their level of competency through real-world industrial projects, and therefore obtain relevant and currently sought after skills. As a result the universities will also get to expand their network as they will be receiving additional international exposure and be involved in more collaboration initiatives with other parties. In addition the research topics that the university pursues become more relevant and closer to the real industry needs and trends. This change will in turn results in the potential of receiving funding and grant opportunities increasing.

- **The industry:** Also benefits from a number of dividends from the process. First of all, the involved partners will receive a sustainable pool of verified potential employees, and will therefore be able to easily obtain qualified specialists in their area of interest. In addition, for a minor investment they could validate some interesting concepts, that they would otherwise not have the time or resources to explore. And at lastly they would have the possibility to get a functioning Product or a concept prototype of their design.

As a result the system and the employed approach become viable and sustainable, allowing for fruitful long-term cooperation.

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Синтетические модели сотрудничества в области университетской кооперации: примеры исследований в научно-исследовательской стартап- школе

В настоящее время существует ряд существующих и достаточно четко определенных схем сотрудничества между университетами и отраслью. Некоторые из наиболее известных моделей: А1 (ВУЗ – как Центр разработчиков), А2 (ВУЗ как центр поддержки сертификации), В (ВУЗ как центр совместных НИОКР) и С (ВУЗ как бизнес-инкубатор). Украинско-германо-канадская образовательная инициатива «Международная научно-исследовательская и пусковая школа», созданная в Национальном Одесском политехническом университете, реализовала синтетическую модель, направленную на устранение некоторых недостатков уже существующих подходов при использовании их сильных сторон.

Ключевые слова: международное сотрудничество университетов, IT-образование, сотрудничество между университетами и промышленностью, стартап-школа, синтетические модели