The symbiosis between university, business and industry: a case study of the Engineering Faculty within *Lucian Blaga* University of Sibiu, Sibiu, Romania

D.D. Dumitrascu & C. Novac

Lucian Blaga University of Sibiu
Sibiu, Romania

ABSTRACT: In a time characterised by global crisis, universities are given the main task of directly connecting its knowledge with knowledge users, namely business, industry and the wider community. Such activities are meant to help industry and technology-based companies in providing jobs for both students and academics; commercialise university-based research; create a bond between technical innovators within the university and both public and private external organisations and, especially, with small- and medium-sized enterprises (SMEs). This paper provides an analysis of the reasons for such collaboration. It is a case study of some of the programmes developed by both academics and students to support the knowledge and technological exchange between university and industry undertaken by the Engineering Faculty within *Lucian Blaga* University of Sibiu, Sibiu, Romania, as representing one institution that develops a wide range of activities and programmes directly and symbiotically connected to industry and business.

INTRODUCTION

European universities have embraced the idea of excellence and assumed a leading role in the global economy through their initiatives. They are no longer simply providing graduates locally; they are also competing on a global scale for students, researchers and industrial partners.

It has been realised within higher education institutions that they will need to provide world class research to attract students and researchers. In order to remain attractive, they will need to open up to business and international partnerships, which may also help to identify new sources of funding. Sharing knowledge, in particular through R&D collaborations with business, while a potential source of income for research institutions, may also provide an important boost to both the quantity and quality of research [1].

Transforming the results of scientific research into modern commercial products is a complex process that involves universities, business and industry. It is already very widely accepted that technical innovations are developed faster through a symbiotic partnership between academia and industry. This is accomplished on both sides, by a strong interdependent relationship. It can be seen in Figure 1 that both academia and industry benefit from such a collaboration.

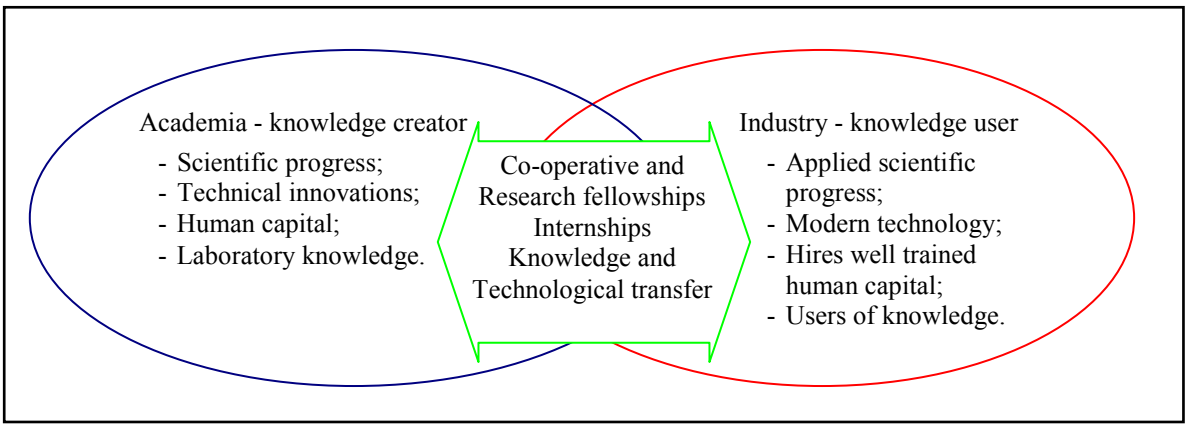

Figure 1: The interdependence of academia and industry.

The involvement of business in the governance of research institutions can help orient research and education activities toward the needs of society, bring expertise to support knowledge transfer, and promote the introduction of innovation-oriented approaches into all fields of activity. Such interaction has helped facilitate the mobility between industry and academia, namely through temporary staff exchanges, as well as through the hiring of young graduates by industry [1].

Other reasons for creating such a symbiotic process are knowledge and technological transfer and the maximisation of economic, industrial, business, social and cultural benefits. Consideration of collaborative academic and industrial programmes requires dealing with three important components of such a collaboration, namely:

1. Creating programmes to support the collaboration;
2. Creating programmes to support the development of entrepreneurial skills of students and academics;
3. Developing programmes to support the actual technology and knowledge transfer between university and industry.

Without the existence of all three, collaboration cannot exist. Extracting value and building a world-class knowledge and technology transfer network is the goal for this University when creating flexible and responsive programmes that serve students, academics, researchers, managers, entrepreneurs and business and industry at the same time.

This scientific approach will prove the efficiency of the symbiosis between university, business and industry and the reasons as to why such relations must be further developed. It also introduces a series of innovative ideas for measuring the impact such collaboration might have on excellence in university, business and industry. Also, presented is a modern approach to training, educating future entrepreneurs and teaching entrepreneurial education in universities.

CIRCUMSTANCES FOR THE SYMBIOSIS BETWEEN UNIVERSITY, BUSINESS AND INDUSTRY

Contextual Factors

Sibiu is located right in the centre of Romania. Most companies that invested in this area are private companies and enterprises. The larger investments are being made in the following fields: food industry; textile industry; trade and commerce; electronic industry; informatics technology; automotive industry; mechanical industry; transport. The development and implementation of the West Industrial Area Project Sibiu, reinforced its status as a city, placing it again in the first rank, as measured by statistics, because of its strong dynamicism in the field of industrial development.

There are now 34 companies involved in this project that cover the industrial fields mentioned above. Sibiu also gained visibility thanks to its being made European Capital of Culture in 2007. According to some recent statistics, most people in Sibiu work in industry, as can be seen in Figure 2.

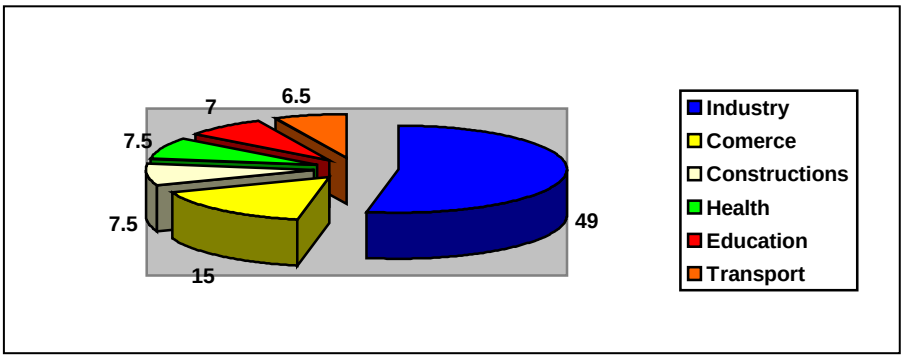

Figure 2: Fields of employment in Sibiu area.

History of the Engineering Faculty

Lucian Blaga University has its roots in the year 1380 as a school and, then, in 1850 as the High Degree Theological and Pedagogical Institute being strongly supported by the church. Due to the fact that the needs of the society were in continuous change, different purposes were associated with this institute, turning it into a Faculty of History, Faculty of Philology, Faculty of Public Administration and an Institute of Sub Engineers.

In 1976, The Institute of Higher Education in Sibiu was founded and it included the Faculty of Mechanical Engineering, offering a degree programme in Mechanical Engineering, training both engineers and junior engineers.

The year 1986 marked a new transformation; the Institute of Higher Education becoming an Institute for Training Engineers in a short-term programme, functioning as part of the Polytechnic Institute of Cluj-Napoca, Romania. The

latter Institute offered degrees in the fields of mechanical engineering, machines and tools, technological and nuclear equipment, automatics and computers, and short-term programmes in mechanical and electrical engineering.

In 1990, the Institute of Higher Education was transformed into the University of Sibiu, and the Faculty of Mechanical Engineering became the Engineering Faculty [2]. The Engineering Faculty now comprises specialisations that are required by both industry and society, namely, industrial engineering, mechanical engineering, mines, oil and gases, engineering and management, computers and information technology, electronic engineering, environment engineering, transportation engineering, applied science and engineering, systems engineering, electronic engineering and telecommunication.

Status of University - Industry Symbiosis

Nowadays, the Engineering Faculty has developed public–private partnerships with 14 industrial partners, most of them situated in the West Industrial Area, Sibiu and has addressed industrial fields of interest to both students and academics, thus creating the basis for supporting further collaborations, as mentioned in Table 1:

Table 1: Companies that collaborate with the Engineering Faculty at *Lucian Blaga* University of Sibiu.

Crt. No.	Company Name	Domains of Activity
1.	S.C. COMPA S.A.	Auto components industry Electronics industry Oil and gas industry Consultancy companies Transport companies Engineering technology Informatics technology companies Industrial soft production companies Mechanics industry
2.	S.C. THYSENKRUPP BILSTEIN COMPA S.A.	
3.	S.C. ATLASSIB S.A.S.C.	
4.	S.C. CONTINENTAL AUTOMOTIVE SYSTEMS S.R.L.	
5.	S.C. KROMBERG & SCHUBERT ROMANIA ME S.R.L.	
6.	S.C. MARQUARD S.R.L.	
7.	S.C. NTN-SNR RULMENTI S.R.L.	
8.	S.C. TRANSGAZ S.A.	
9.	S.C. ROMGAZ S.R.L.	
10.	S.C. 3SOFT AUTOMOTIVE S.R.L.	
11.	S.C. EBS ROMANIA S.R.L.	
12.	S.C. CEPROCS S.R.L.	
13.	TAKATA-PETRI S.R.L.	
14.	S.C. NET BRINEL S.R.L.	

Creating Programmes to Support Collaboration

Engineering, with its specialisations and applied science-based subjects, has always been strongly connected with industry, through education and research. This kind of partnership was achieved by research and development contracts; technical and economic consultancy services; knowledge transfer; technological transfer; provision of financial support for students' scholarships and training; internships contracts; and donations and sponsorships for different academic and student activities. Engineering also featured in such interesting courses of study as: Modelling, Drawing and Assembling in ProEngineer developed with the Fritzmeier Engineering Sibiu company; ABAQUS applications and Finite Element Analysis developed with the Continental Automotive Systems Sibiu company. The Engineering Faculty participates in such collaborations.

Creating Programmes to Support the Development of Entrepreneurial Skills of Students and Academics

To support the collaboration between academia and industry, the Engineering Faculty adopted two strategies: one concerning the students and academics of the Faculty - its internal environment; and the other directed towards the external environment, namely business and industry. The infrastructure and financial support thus came from both inside the Faculty (own income, European funds) and outside the Faculty (donations, sponsorships, technological transfer).

A modern approach to training students in a real-world entrepreneurial spirit required giving up the theoretical emphasis and moving the focus towards real practice, using case studies and simulated industrial environments in laboratories.

In 2000, the Engineering Faculty, as a member of an academic consortium with three other universities and with the financial help of the World Bank, initiated a programme entitled COMPASIM, to set up a simulated company located in a laboratory inside the Engineering Faculty at the Department of Economic Engineering.

One of the objectives of the simulated company is to create an environment as close as possible to a real one inside an industrial company, with its own technical and computerised equipment. This laboratory was meant to facilitate

students' access to practice in a real company. The economic and financial effects were evident in the low labour costs of students and staff using modern technology in a stable laboratory environment and location.

Another important purpose was to initiate a students' course in which entrepreneurial skills were developed. Students are now taught and educated on how to start a new venture with the hope of making profit. Through this entrepreneurial project, the Engineering Faculty provided both well-trained human capital and knowledge for strong innovation and economic growth, especially in a knowledge-based society in the Sibiu area.

In 2010/2011, *Lucian Blaga* University of Sibiu together with six other partners formed a consortium of universities and participated as a partner in a European-funded project concerning the restructuring of student practice in technical higher education.

The project, entitled TRIPOD, became the main concern of the Engineering Faculty within *Lucian Blaga* University of Sibiu, thanks to its domains of education and technical and industrial academic specialisations. The project's main goal was that of creating and developing specified technical competences in the studied field at the level of senior students in technical higher education. The idea was to improve the qualification level of students and, hence, facilitate a higher insertion and absorption level into the labour market. This would aid funding and develop and strengthen the symbiosis between university and industry.

Another goal of this project was that of adapting the academic curriculum of technical higher education to meet the needs of the labour market. The students worked in a number of industrial companies and were put face-to-face with their future employers and managers, hence, being exposed to a real industrial and economic environment. The project was important for all parties and involved:

- The students and academics of the university;
- The managers and employees of the industry;
- The community itself - which determines the products and services the community uses.

Developing Programmes for Supporting the Actual Technology and Knowledge Transfer between University and Industry

Most of the programmes adopted by the Engineering Faculty, in this case, are developed in centres of research, some of them under the direct supervision of the faculty managers, deans, industrial representatives or managers and provide the formal basis for the partnership between the Faculty and industry.

Some of the centres identified so far are: Centre of Quality Research; Centre of Studies and Researches in the Field of Plastic Deformations; Centre of Research and Implementation of Numeric Methods; Centre for Unconventional Technologies and Electro Technologies; Centre of Research in Materials Engineering; CISCO Academy; Centre of Research in Intelligent Technologies; Centre for Research and Consultancy for Industrial Business, and many others. Research Partnership Programmes help the collaboration between university researchers and industry, providing a prolific ground for the new knowledge, expertise and technology to be transferred to those who need it.

Reasons for Academia to Work with Industry/Business

In all developed countries higher education institutions are strongly encouraged by the governments to develop new strategies of working with business and industry. A number of benefits and opportunities for universities are perceived from the stronger collaboration with business and industry, such as those expressed below:

1. Opportunity to attract additional funds for technology and research, increasing the financial autonomy of the university, taking into account the fact that the core funding may be lowered by the state;
2. Access to modern technology and equipment;
3. Working in a real environment; namely, students and academics are familiarised with working in a real industrial company or enterprise;
4. Adapting the faculty curriculum to the needs of the labour market;
5. Further income resulting from consultancy services, internships;
6. Research opportunities;
7. Reward systems for both academic staff in the form of salaries and for students in the form of scholarships.

Reasons for Industry/Business to Work with Academia

The reasons for small- and medium-sized enterprises (SMEs), industrial companies and enterprises to collaborate with higher education institutions involve all the elements involved in sustaining the symbiosis. Some of the most important are expressed as:

1. Obtaining access to university facilities especially those involving engineering, informatics or mathematics;
2. Enhancing technological capability;
3. Developing new products;
4. Enhancing management skills and knowledge;
5. Participating in the graduate recruitment strategy;
6. Enhancing technological capacity.

Outcomes Expressed from the University Industry Symbiosis

There are two types of outcome that can be expressed from the symbiosis between university, business and industry, namely: tangible and intangible outcomes. The tangible outcomes are represented by disseminating the information and knowledge through articles, books and scientific papers and also through the increased number of Masters and doctoral degrees developed in partnership with business and industry and required to meet the labour market needs. The intangible outcomes are those coming from providing solutions to problems as required by business and industrial representatives and from accessing modern technology.

Lessons from International Experience - WIETE - When one Door Closes Another One Opens

The example of the Engineering Faculty within *Lucian Blaga* University of Sibiu can be considered relevant to Romania. An international example of good practice for the development and use of the symbiotic process that takes place between academia, business and industry is the World Institute for Engineering and Technology Education (WIETE), a model that must be followed so as to reach a state of excellence both in teaching and research, and in applying and using the products of the first two.

The WIETE, as a large group of experienced scientists and researchers, was initiated in 2009, in Melbourne, Australia, under the Directorship of Professor Zenon Jan Pudlowski. Its mission is that of developing and maintaining a global independent network of individuals and institutions concerned with the quality of engineering and technology education. The WIETE seeks to promote international collaboration and dissemination of information on research and development in this area of academic endeavour [3].

The researchers from WIETE found there were areas of opportunity within academia working with industry, especially involving engineering, to establish objectives to be followed, not necessarily inside their institute but in any higher education institution involved in such partnerships, namely to:

1. Create and maintain an international platform for the exchange of information on engineering and technology education;
2. Promote and facilitate international collaboration in engineering and technology education;
3. Stimulate, encourage and pursue research and development activities in engineering and technology education, and multidisciplinary research, in order to link the science of engineering and technology with other disciplines;
4. Provide consultancy services in engineering and technology education for educational institutions, governments, professional societies and industrial organisations;
5. Organise and conduct short courses, international seminars and conferences on engineering and technology education to promote innovation, best practice, human resource development and capacity building;
6. Initiate, stimulate and co-ordinate international postgraduate activities in engineering and technology education;
7. Establish and maintain interest groups, regional networks and Centres of Excellence in engineering and technology education;
8. Disseminate information, expertise and research results through various media, such as printing and electronic publishing;
9. Seek financial support for research and development activities to be carried out by member institutions [3].

It is quite possible, in the authors' opinion, for a future initiative and partnership to be established between the World Institute for Engineering and Technological Education and the Engineering Faculty within *Lucian Blaga* University of Sibiu, due to their similar goals and approaches towards academia and industry. New programmes, doctoral and postdoctoral activities, research, publications, other joint activities or conferences can be established or organised in the agenda of the following academic years, thus, uniting two continents, two different countries and two ways of thinking and approaching academia and industry, but most of all in two ways of embracing education and research.

CONCLUSIONS

The key to supporting the symbiotic relationship between university and industry means first of all a strong will for productive collaboration from both parties. Such interactions have increased gradually over the past few years, involving contractual research or collaborative research or structured partnerships.

Universities and industrial companies are now assuming each other's tasks and roles, and, as the university crosses traditional boundaries in developing new linkages to industry, it has to develop the connections between research, teaching and economic development. The Engineering Faculty at *Lucian Blaga* University of Sibiu is an example of good practice and is proof that the symbiosis between academia and industry works and can be successfully developed further.

The connection between academia - industry - business - society is considered important when it produces value and adds value to that already existing. Trying to measure the impact of such a partnership or symbiotic process is a hard task but not impossible; most times, the effects are seen and can be counted only after a long period of time, long after the educational activities are finished. The fact that the number of interactions between academia, business and industry registers continuous growth can be a useful indicator for measuring the impact of this symbiosis and can be the theme of a future scientific study.

A good comprehension of the symbiotic process between academia, business and industry is obviously interdisciplinary in nature, meaning expertise must come from more than one discipline and the implication should come from all sides, be they academics, researchers, students, managers or engineers.

The importance of this type of collaboration and interaction directly comes from raising the innovative capacity of the enterprises and companies in the region, developing new skills for the economy and most of all from knowledge generation that contributes to economic regeneration.

REFERENCES

1. European Commission, Directorate General for Enterprise and Industry. Improving Knowledge Transfer Between Research Institutions and Industry Across Europe. Luxembourg, Belgium: Office for Official Publications of the European Communities, 7-8 (2007).
2. History of *Lucian Blaga* University of Sibiu, September 2012, http://www.ulbsibiu.ro/en/despre_ulbs/istoria_ulb.php
3. Pudlowski, Z.J., WIETE - a global hub of engineering and technology education. ATEEM, Taiwan: *Inter. J. of Technol. and Engng. Educ.*, 7, **3**, 1-7 (2010).