

The innovative aspect of collaboration between universities and industry



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The purpose of this article is to describe the innovative partnership of science, education and industrial sectors. Allocated to the target stakeholders of the University–industrial cooperation (business environment, state, and University environment). The barriers and issues to be addressed in the field of University–industrial cooperation. Selected evaluation criteria of the system support innovation in academia and the reasons for the participation of enterprises with universities in joint research.

Keywords: Innovations in collaboration, University–industrial cooperation.

Today the knowledge is perceived as a strategic resource, the source of competitive advantage and sustainability. The integrational processes of science, education and industry now play the key part in the context of economic. The development of this kind of partnership goes in the educational area, staffing, innovative research and consulting support. It is important to note that university–industry collaboration implies not only collaboration between universities and industry, but the state as well (fig. 1).

Educational institutions pursue the goals of obtaining relevance of research and employment for graduates, attracting additional sources of financing as well as obtaining access to technically equipped laboratories. Industrial facilities see universities as potential partners in dealing with staff matters, consulting and securing technological leadership position. The interest of the state in turn is to find instruments of modernization of economic and providing the technical progress. There are various models of state politics to stimulate these processes; each of these models uses its own set of instruments: organizing appropriate committees, providing additional financing, state orders and legislation.

Due to the intersection of interests the collaboration between the universities and the industry has led to the development of this kind of collaboration on the worldwide scale. However, the partnership in this sphere does develop against the barriers formed by various opposing positions

of the parties (table 1). First of all, there are differences in the objectives of activities. Business systems are mainly interested in development of applied science and introduction of solutions while educational environment is focused on fundamental research. It also should be noted that the more integration is developed, the higher the chances for situations when corporate interests start to directly influence scientific research [2]. The second controversial point is associated with value factor. The companies are interested in keeping their competitive advantage thus securing market success. Academic environment tend to be more open-minded in this sphere, accumulating interdisciplinary knowledge. The third controversial point is associated with international integration. These spheres do actively experience the integration processes meaning that cross-cultural factor

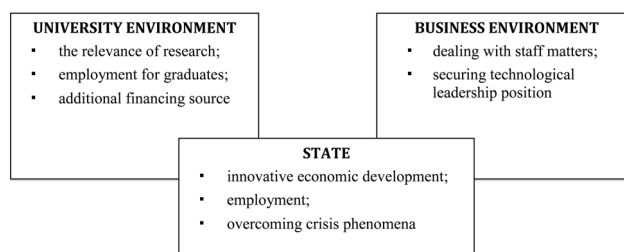


Fig. 1. Goals of the interested parties of the university–industry collaboration

Barriers in the way of university–industry collaboration

At the universities' side	At the business' side
Lack of financing for the science (both state and private)	Difficulty in defining potential partners in academic environment
Joint work with business environment has no influence on career progression within academic activity	Lack of free funds for projects' financing, limited availability of resources for collaboration
Lack of time as well as other resources for projects' development	Inadequate alignment of objectives: a tension between business needs and university needs
Conflicts between scientific goals (publication activity) and commercial secrets	Focusing on short-term R&D instead of long-term ones
Lack of trust in the representatives of the business environment	Overall low level of R&D business investments
organizational barriers	Lack of understanding of the potential advantages of working with the universities at the business' side

and international law heavily influence the degree of collaboration.

There are numerous examples of successful cooperation, but due to existing conflicts the following issues shall be resolved in order to establish cooperation:

1. Forms and models of cooperation. Number and structure of participants do vary between the models of cooperation: «university–companies», «universities–company», «universities–companies». The cooperation may be implemented in the following forms:
 - development of curricula;
 - permanent education (AVT);
 - student/academic mobility;
 - commercialization of R&D projects;
 - joint R&D projects;
 - consulting;
 - small innovative businesses within universities.
2. Factors contributing to the development of renewable and long-term partnerships.

Experience of USA, Great Britain and Japan provided various variants of implementation of cooperation subsequently replicated on a worldwide scale. [6] International practice shows that cooperation between business and universities aligns subject to the influence of various factors:

1. Historical and national heritage. World-class events do influence the process of forming and development of partnerships. Both scope and results of World War II have kickstarted the cooperation between military-industrial companies and universities of USA in the field of implementing fundamental and applied research.
2. State funding and support of partnership. The most important factor of the partnership development shall be the general level of state funding.
3. Economic situation. During economic recessions the companies substitute costly internal R&D with cheaper contractual research, mostly provided by international partners. The experience of industrial financing in USA and Great Britain shows that unstable economic situation does not lead to reduction in financing the science by the industrial sector [7].
4. Scientific orientation of higher educational institutes. Biological, medical and engineering sciences form a key sphere enjoying the most rapid development of partnership in the last two decades. As an example of such partnership the Horizon 2020 project, an

EU program for research and innovations with total budget of 80 billion euro, can be named [1].

5. Companies' administration staff. The flexibility of operational framework during cooperation as well as employers representation in managing the university does influence the ability of partnership. For example, many industry representatives are included in higher representative bodies of MIT, thus facilitating the interaction of the university with the real sector.

Innovative aspect of collaboration

University knowledge-based business is often associated with technology transfer in a specific form of cooperation between scientific circles and industry. The main idea of transfer technology is quite simple. Results of the university research are meant to be used in industry. This goal can be reached by the means of such formal mechanisms as licensing and creating a university-based company. Despite the cooperation between scientific circles and industry is often viewed in the frames of technology transfer, there is no compelling reasons to limit the degree of cooperation between scientific circles and industry in the technological spheres. The industry can as well use the contribution of social and humanitarian sciences (for example, knowledge of marketable product in different cultural and language context, development of the effective organization, organizational procedures etc.). For example, a professor of theology had given an expert opinion on symbols and texts to be used in the chapel of Tallinn airport, Estonia (Tallinn University) [8]. Therefore, universities began to include humanitarian and social sciences in curricula. Expansion of the volume of information transferred from the scientific community to the industry grows in a positive trend.

There are four main reasons for companies to cooperate with universities to create innovative products:

1. Companies strive to finance R&D. State funding is often available for the companies cooperating with universities [5]. Many social financing programs for science do encourage and include the contribution of industry. The European Commission provides resources for such programs based on an example of USA funding framework such as advanced technology program, Great Britain research council, national health service programs etc. [3]. For example, R&D costs of USA Biotechnological companies being in alliances with universities and companies thereof are

Main criteria for evaluation of innovation support system in the scientific circles

Level	Direct commercialization or support for individual innovation ideas	Indirect commercialization or support for individual innovation ideas at organizational level
Initial	Chosen recruits are accepted with appropriate knowledge. The university management trusts recruited team. Address the faculty board for building trust. Set up a basic system for supporting innovations associated with students	Focusing on the strategically strong fields of the university in a peer-to-peer structure. Recruitment of people with appropriate knowledge (preferably having skills both in research activity and business). Attract the best researchers within the framework of selected areas and propose some applicable companies to participate. Focus on topics proposed by the companies and found to be academically relevant by researchers
Basic	Set up processes to evaluate the innovations from both technical and business point of view. Set up a business incubator focused on business development as well as kickstart the commercialization projects. Set up processes for creating new enterprises as well as beyond licensed projects. Set up main funds for projects' commercialization	Starting the joint pilot projects. Set up such events for discovery of additional possibilities of cooperation as AIMday. Establish various grants and awards to mark the progress. Set up special entrepreneurship and IP programmes for students, postgraduates and masters for selected disciplines
Advanced	Methods of patenting support and advices on legal business processes are set up at professional level. Commercialization programmes are drawn for students, postgraduates and researchers. University funds for innovations are set up	Various intellectual assets being constantly evaluated by research departments and used as having experience/knowledge. In addition to key companies such additional executors as suppliers and clients are being used
Optimal	Autonomy is guaranteed by profitable results of startup and base companies, dividends on companies' profitable portfolio, royalty on income on patents in existing companies during the licensing period	Autonomy is ensured by regular annual membership fees, sponsorship, conferences, scientific research financing. All ideas are regularly commercialized on account of partnership companies and/or new startups

more innovative than those who aren't a part of joint projects.

2. Companies strive to gain access to basic scientific knowledge. Participation enables them to get a better insight in the very technologies increasing the knowledge base.
3. Companies strive to address the matters of concern on account of university consultations on current R&D programs. The researchers in these cases are being involved in tests, perform tests, participate in R&D and provide feedback in preliminary results. Most companies give the universities the part of «assistance for project finish stage» instead of «development of a new project».
4. The cooperation with universities leads to general benefits beyond the narrow goals of specific unions. Education sector is a source of new methods and instruments for development of new technologies. Cooperation with university gives a positive impact on a company's goodwill, raising the attractiveness thereof not only for partners but also for potential employees. By attracting the university researchers, a company gets the possibility of attracting new scientists for co-authorship or consulting.

If a system for innovation support in the scientific circles exists, its functioning shall be evaluated. There are some preliminary criteria that could be used in evaluation (table 2) [3].

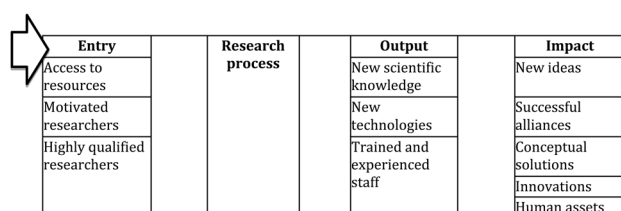


Fig. 2. A chart for evaluating the success map

Markus Perkmann, Andy Neely and Kathryn Walsh [3] propose a system of evaluating the performance for university–industry alliances: a success map is drawn according to existing research of current relations showing causal chains underpinning the success (figure 2).

The enterprises are increasingly becoming a source for creating university–industry relationships, for example such pharmaceutical companies as GlaxoSmithKline and Novartis do enjoy the availability of academic research in the field of research of specific human diseases. Such machine-building companies as Rolls Royce do work with scientific departments of various fields, including research on aerodynamics, ignition systems and software. The governments support such relationships by providing subsidies to R&D activities.

A knowledge-based economic sets new goals for scientific communities. The main issue is to decide if the research institutes should continue traditional education or switch to entrepreneurship institutes. Based on experience of leading Swedish and two Estonian universities, Markus Perkmann, Andy Neely and Kathryn Walsh state that new economic and social circumstances haven't transformed these universities into new entrepreneurial activity. These universities remain traditional higher education institutes, but with a certain additional function of having support of entrepreneurship and innovation processes.

Within the framework of this general conclusion it's worth to note that each university has a goal of using its traditions, strong points, regional positions, human resources and other specific advantages to cope with new challenges of the 21st century.

Commitment to innovation support has two aspects:

- It should not be exclusively limited by licensing, creation of university-based enterprises and other traditional business processes.
- It is very important to dedicate more attention and resources to consolidate cooperation between scientific communities and business industry.

Most often it is the collaboration between industry and scientific circles that is the main condition of transferring scientific knowledge to industry. Such transfer shall be based on interests and mutual benefit of both parties. A university should not strive to generate high revenues from IP operation.

For example, a major gas turbine producer consulted with an expert scientist when the company experienced critical problems of vibrations with turbine prototype sometimes leading to self-destruct thereof [4]. Company engineers couldn't determine the reason of this periodically arising problem; so they hoped that an R&D group specializing on turbine aerodynamics could provide necessary help and perform an expert evaluation. The R&D group decided to undertake the task despite the concerns that this project was focused on development and short-term results much more than an ordinary R&D project. Company prototypes were installed in the university lab. This project involved the collaboration of four scientists of various degrees of experience during a period of six months. At last the R&D group was able to determine the cause of the problem as the self-ignition, i.e. uncontrollable fuel explosion in the engine; and, subsequently, the group cooperated with the company to experiment on various constructs to overcome this problem.

In other case, a professor of industry sphere specializing on risk modelling was consulted by an international oil company to provide a risk assessment for modernizing an oil platform. [3] The staff insisted that safety equipment should be installed on the main inhabited platform while safety managers expressed an opinion that said equipment should be installed on a remote site that actually extracted oil, but maintenance thereof was more costly. In order to come to investment solution for the company, the professor was introduced to operation to be able to model risks associated with said constructions.

Transfer of new knowledge is a very delicate task, so based on analyzed data there are reasons to believe that a certain confusion exists on the topic of what the very knowledge is, as well as how and when it is transferred to the companies.

To increase the viability of relations in joint projects between the university and enterprises the companies shall be instructed on the following aspects:

- contact with university management and education department to perceive future prospects of researchers and students;
- provide the students with corporate world tutors who can help to familiarize with the world of business, reflect the goals and values of the company.

From the university side there is a need in providing stimuli structure to encourage cooperation and collaboration of the companies as well as including students in the projects of current research. Currently this is generally non-existent. For example, company shares are almost unanimously related to research papers' publications.

Therefore, university–industry collaboration is an effective instrument for development of knowledge

economic, being implemented in educational, research and scale-event direction. UIC is developed through the influence of various factors. In the long term the influence of all range of factors shall be counted. Considering the experience of the developed countries, the factors' combination influences the selection of collaboration forms as well as effectiveness of a given process in the long-term.

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References

1. Horizon 2020. The EU framework programme for research and innovation <https://ec.europa.eu/programmes/horizon2020>.
2. International trends in higher education 2015. University of Oxford. <https://www.ox.ac.uk/sites/files/oxford/International%20Trends%20in%20Higher%20Education%202015.pdf>.
3. A. Kelli, T. Mets, L. Jonsson, H. Pisuke, A. Trames. The changing approach in academia–industry collaboration: from profit orientation to innovation support. 2013.
4. D. Mingullo, M. Thelwall. Research excellence and university–industry collaboration in UK science parks//Research Evaluation 24. 2015. P. 181-196.
5. M. Perkmann, A. Neely, K. Walsh. How should firms evaluate success in university–industry alliances? A performance measurement system//R&D Management Blackwell Publishing Ltd. 2011.
6. A. Piacentini. The University – Industry Partnership. A new format to promote innovation. <http://dpc.sa.gov.au/sites/default/files/pubimages/documents/office-for-international-coordination/20%20-%20Piacentini.pdf>.
7. Sachi Hatakenaka. University–Industry Partnerships in MIT, Cambridge, and Tokyo: Storytelling Across Boundaries. Routledge, 2004. – 272 p.
8. J. Walliy, O. Isaksson. Bridging the gap between university and industry: three mechanisms for innovation efficiency//International Journal of Innovation and Technology Management, World Scientific Publishing. Vol. 11. № 1. 2014.

Инновационный аспект сотрудничества университетов и промышленных предприятий

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Цель статьи состоит в описании инновационного вида партнерства науки, образования и промышленного сектора. Выделены цели заинтересованных сторон университетско-промышленного сотрудничества (бизнес-среды, государства, университетской среды). Рассмотрены барьеры и вопросы, требующие решения в области университетско-промышленного сотрудничества. Выделены критерии оценки системы поддержки инноваций в научных кругах и причины участия предприятий и университетов в совместных исследованиях.

Ключевые слова: инновации в сотрудничестве, университетско-промышленное сотрудничество.