UNIVERSITY/INDUSTRY PARTNERSHIP PROJECTS – BY THE CREATIVE WAY TO PRACTICAL KNOWLEDGE: THE GOALS AND BENEFITS OF THE LOGISTICS PROJECT

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Abstract

Global competitive environment encourages cooperation between industry and the higher education institutions to get mutual benefits, but recently the focus is also on participation of students in these partnerships. The paper represents good practice of industry/university cooperation with participating students through the presentation of the logistics work-study project. The key benefits of the project are recognized in students' upgraded or acquired competencies, new scientific instrumentation and methodology for faculty and technological know-how, as well as in increasing absorptive capacity of company for scientific and technological problem-solving, in networks and social interactions. Thus potential partners should establish long-term partnerships as well as they should search for appropriate calls and funds to apply for these kinds of projects. Although the faculty and the company have established long-term partnership, students was not able to establish such partnership, because funds and consequently duration of the project were limited. Therefore companies should also provide financial funds to invest in their potential employees, especially when it

comes to a public company with less stimulating working environment and predominantly older workforce.

Key words: logistics work-study project, higher education/industry cooperation, students engagement, case study, performanece discussions.

1. INTRODUCTION: COOPERATION BETWEEN HIGHER EDUCATION INSTITUTIONS AND INDUSTRY

An increased youth unemployment was estimated to have reached five million across the European Union in August 2014. This situation has prompted many governments, the European Commission and the OECD to emphasise the need for closer links between higher education institutuions and industry to stress innovation policies and graduate employability. Universities are placing more focus on developing the practical and entrepreneurial skills of their students, and on promoting innovation and stakeholder partnerships. They are also engaging more within their local communities, with employers, business, and industry while also extending their reach internationally. The percentage of institutions which consider that cooperation with industry is highly important is 53 % in 2015 and is expected to grow to around 70 % in few years (Sursock, 2015, p. 23-54).

Labour markets increasingly rely on higher skill levels and transversal competences, therfore higher education institutions should equip students with the advanced knowledge, skills and competences they need throughout their professional lives. Universities shoud raise initial qualifications as well as maintain and renewe skilled workforce through close cooperation between governments, higher education institutions, social partners and students, which will allow institutions to be more responsive to employers' needs and employers to better understand the educational perspective. The European Universities' Charter on Lifelong Learning developed by the European University Association provides a useful input for defining strong partnerships between public authorities, higher education institutions, students, employers and employees. Learning outcomes can be recognized in the knowledge, skills and competences, which can be acquired through formal, non formal, or informal learning paths. Lifelong learning is also supported by adequate organisational structures and funding, as well as it is encouraged by national policies (EHEA, 2009, p. 3).

To foster innovation and creativity in society, higher education should be based at all levels on state of the art research and development. The potential of higher education programmes, including those based on applied science, is recognized to catalyze the innovative society, therefore also the number of people with research competences should increase. Also, doctoral programmes should be complemented by interdisciplinary and multidisciplinary programmes to provide high quality disciplinary research (EHEA, 2009, p. 4). Advanced degree levels, M.Sc. and Ph.D., should also be responsive to industrial requirements (Altbach, Reisberg & Rumbley, 2009, p. 158). Highly skilled graduates are the indeed key inputs for successful industrial development in a given society (Puuka & Marmolejo, 2008). In Slovenia,

employers usually demand paractical/working experience from new emloyees, wherein logistics is not excluded.

IBM, a worldwide leading catalyst for so caled service science, thus strives to develop a new discipline that (IBM, 2012):

"… *integrates aspects of established fields like computer science, operations research, engineering, management sciences, business strategy, social and cognitive sciences, and legal sciences.*"

Because of the interdisciplinarity, multidisciplinarity and applied nature, logistics actually represents an area, which responds very strongly to these requirements.

1.1 Benefits of cooperation

Since 1980s, the competitive environment has forced companies to introduce new technologies and innovations to shorten product and technological life-cycles. Therefore companies has started to accumulate knowledge and skills through the introduction of R&D. These activities take place at the vertikal or horizontal channels, where vertical spillovers, associated with suppliers and customers, usually have more significant effect on R&D then horizontal spillovers, which are associated with universities and research institutes (Faria et al., 2010, p. 1082-1083). Companies' innovation cooperation strategy is based on the type of external partenrs who might also be the universities, which mainly provide knowledge to aid defining trajectories that are new to the firm (Bercovitz & Feldman, 2007, p. 931). The knowledge, which is produced in this kind of cooperation, improves an existing life-cycles in companies, as it allows to better deploy their existing capabilities. Companies also obtain benefits from the cooperation with universities, as it might also be the way of sharing costs by complementing other R&D and innovation activities, such as own R&D, cooperation with other partners as well as the search for publicly available knowledge (Faria et al., 2010, p. 1084).

The pressure on universities to cooperate with industry is still an issue in Europe, where each region searches its own way to involve universities into regional development (Azagra-Caro, 2006, p. 38). For the university, this kind of cooperation creates knowledge that provides new findings and potential scientific breakthroughs (Bercovitz & Feldman, 2007, p. 933). These benefits are also well illustrated with the following words (Altbach et al., 2009, p. 154):

"… *Technological innovation is advanced by having a two-way flow of information – not only of science from universities to industry but of technological know-how from industry to universities*."

An emerging literature describes specific student participation in so caled "*co-op education programs*" or work-study programs, which are regarded as innovative in three different ways (Bramwell & Wolfe, 2008, p.1175-1185): First, it helps companies to identify new recruites; second, students help companies acquire new skills and knowledge from the university; and third, the cooperative students and programs provide mutual flows of knowledge and know-how across the university and local companies. In these work-study programs student groups work on specific

problems identified in local companies, community and government organizations (Puuka & Marmolejo, 2008).

Cooperation between higher education institutions and industry is more likely to occur with large firms and with firms that receive public funding for innovation, since these firms have more resources to invest in research that does not have an immediate market orientation (Faria et al., 2010, p. 1084).

In Europe, one survey reported that the number of start-ups increased by 10 percent annually between 2004 and 2007 and that European universities have been more efficiently generating these operations based on funds invested in research than US universities (Altbach et al., 2009, p. 155).

Research and development institutions (R&D), especially higher education institutions, should exploit all the given channels of knowledge transfers, that are recognized especially by networks, continuing professional development, consultancy, collaborative research, contract research, licensing, spin-outs, and finally, teaching (EC, 2009, p. 5). Recommended core performance indicators for the transfer of knowledge of public research organizations are: research agreements, invention disclosures, patent applications, patent grants, licences executed, licence income earned, spin-offs established (EC, 2009, p. i).

1.2 Assumptions and limitations of cooperation

Absorptive capacity of companies has been widely used concept to analyze innovation processes and the effect of organizational learning on the creation of sustainable competitive advantage, which has a cumulative character in the sense that its development in the present will permit its more efficient accumulation in the future. It involves three basic capacities in relation to new knowledge: recognition of its value; its assimilation; and its application for commercial ends (Vega-Jurado et al., 2007, p. 2). R&D activities have short-term and long-term effects on absorptive capacity, where the first are directly linked to R&D investment and have a positive influence on all types of absorptive capacity, while the second have a cumulative effect, which contributes to the acquisition of solid experience in a given technological trajectory and is particularly relevant for the absorption of scientific knowledge, which requires greater capacities for the acquisition and exploitation then the industrial knowledge. Thus, the company's internal knowledge, gained through education of personnel or R&D activities, is a key factor in the absorption of external knowledge from scientific sources (Vega-Jurado et al., 2007, p. 19).

Companies invest in university based research projects when they are more likely to be considered part of an ongoing relationship when the firm is pursuing an internal innovation strategy more heavily weighted toward exploration (rather then exploitation) and when a greater share of the research conducted at universities is exploratory (Bercovitz & Feldman, 2007, p. 944-945).

In this paper, an example of good practice of university/industry cooperation is presented to highlight the benefits of funding the projects, where students are directly connected with company. First, the funding and aims of the project are introduced, as well as the company itself. Next, goals as well as benefits are presented through project team tasks and achieved students' competencies.

2. THE PROJECT: THE METHOD OF INTRODUCTION OF SMART METERS FOR READING THE ACTUAL CONSUMPTION OF DRINKING WATER

The Public Fund of the Republic of Slovenia for human resources development and scholarships, which operates within the Slovenian Ministry of Education, Science and Sport, has tendered project with financial assistance from the European Social Fund, named "By the creative way to practical knowledge", to which Faculty of Logistics has also applied its ideas. The faculty has acquired 12 projects, and the presented project is only one of them.

2.1 Introduction and Rationale

The project has started in March 2015 with a run-time of 5 months. Its main goal was to optimize working processes in public service company, located in the city of Maribor. Genarally, services tend to have markedly weaker direct links with universities than do manufacturers (Tether & Tajar, 2008, p. 1093), thus the aim to connect with this company seemed rationale in order to improve this statistics and also in order to introduce innovative solutions to a public service company that does not have an immediate market orientation.

In this project students from the Faculty of logistics (FL UM) and the Faculty of mechanical engerneering (FS UM) of the University of Maribor have participated to offer their knowledge, as well as innovative and smart solutions that was implemented in business processes of the company. With this kind of participation, students have got deeper insight into a real working environment, where they upgraded their working experience and skills, as well as professional competencies (Final report of the project, 2015).

Project team was made from (Application form of the project, 2014):

- 10 students – 5 from FL UM and 5 from FS UM,
- 2 teaching menthors – one from both faculties (FL UM and FS UM);
- 2 working menthors – one from the company (Maribor waterworks), who was responsible for the professional guidance, and the other from the social organization (youth center CMLC), who was responsible for promoting the project; and
- 1 coordinator from FL UM.

Maribor waterworks is a company, which supplies drinking water for 200,000 inhabitants of seventeen municipalities and has registered 45,000 water connections (Erker & Rataj, 2015). One of the key processes in the company is the reading of water meters, that requires smart solutions, as small number of workers must read the large number of water connections. This problem can be solved by intelligent use of modern information technologies, while solutions can also have a direct impact on solving the problem of water losses (Mariborski vodovod, 2015).

On the market there are different meters for reading the state of drinking water consumption, which differ in performance and price. Therefore students of mechanical engeneering made cost-benefit analysis of smart meters according to different needs, which depend mainly on the type of consumer. They had also

participated the process of replacing/installing, repairing and warehousing the meters to optimize these processes and to make their improved workflows with key critical points and finally to make new operational instructions for installation of smart meters. On the other hand, students of logistics were looking for solutions to optimize the working routes that are required to replace/install meters as well as to read the monthly state of water consumption. They were forced to investigate the specific needs and requirements of these processes, and to explore relevant and affordable software. Therefore they made the decision model, which determines working routes via the interactive map (Application form of the project, 2014; Final report of the project, 2015).

Under the mentorship of youth center, students got instructions on how to promote the project and present its results, which should meet the public interest. They had also prepared all the promotional materials, which was made to use on the selected promotional events (Application form of the project, 2014).

2.2 Goals and structure of the project

The primary objective of the project was the interdisciplinary problem solving of students from various fields in the real environment, i.e. concrete problem of selected company. Innovative approaches were needed to overcome the scarcity of resources (technological, financial). These activities had the indirect impact on the students' specific working as well as generic competences (Application form of the project, 2014).

The company Maribor waterworks wanted to reach the correct and professional attitude to its customers. By the achievment of "win-win" situation between all participants in the business process each customers would pay monthly cost of the actual consumption. The achievement of this goal would also help to detect inadmissible spending deviations, which would allow the identification of sites of water losses. Management of water losses would thus be the next project of the company, which could also be planned together with students and higher education institutions (Application form of the project, 2014).

The goal of higher education institution, ie. FL UM, was to participate and coordinate this project to get new coordinating and managerial competencies as well as more close contact with industry (Application form of the project, 2014). For this reason FL UM and Maribor waterworks signed contract on mutual cooperation even before the project had started.

The goals and structure of the project can most clearly be seen via structured tasks of all the participants of project team, presented in Table 1.

Table 1. Tasks of project team

Member	Status	Tasks
Student 1	Master degree programme: System logistics	- to ensure the relevant theoretical foundations of the project in the field of logistics, - to record the process of reading the status of drinking water, - to make the decision model, - to promote the project, and - to communicate with the public
Student 2 and Student 3	University degree programme: System logistics	- to record the process of reading the status of drinking water, - to study the software, - to transform theory into practice, - to create the applications, and - to create the promotional materials
Student 4 and Student 5	Professional degree programme: Economic and technical logistics	- to record the process of reading the status of drinking water, - to transform theory into practice, - to create the interactive map
Student 6	Master degree programme:	- to ensure the relevant theoretical foundations of the project in the field of mechanical engineering, - to record the processes of replacing/installing, repairing and warehousing the meters, - to make the plan for pilot implementation of new operational instructions, - to promote the project, and - to communicate with the public

Student 7	University degree programme: Mechanical Engineering	- to record the processes of replacing, repairing and warehousing the meters, - to study the functioning of smart meters, - to transform theory into practice, - to professionally support the creation of applications, and - to create the promotional materials
Student 8	University degree programme: Mechatronics	- to record the process of installation of smart meters (the type of meters and the method of reading the meters), - to transform theory into practice, - programming the meters, - professionally support the creation of applications, and - to create the promotional materials
Student 9	Professional degree programme: Mechanical Engineering	- to record the processes of replacing, repairing and warehousing the meters, - to transform theory into practice, and - to make the operating instructions for the installation and maintenance of smart meters
Student 10	Professional degree programme: Mechatronics	- to record the process of installation of smart meters (the type of meters and the method of reading the meters), - to transform theory into practice, - to make the operating instructions for the installation and maintenance of smart meters

Educational mentor 1 and Educational mentor 2	Teachnig Professors at University of Maribor: Faculty of logistics and Faculty of mechanical engeneering	- to give advices on the theoretical foundations, methods and procedures
Working mentor 1	IT manager of the company	- to familiarize students with the key processes and responsible persons in the company, - to organize visits of students - to give advices on the possibilities of implementation of practical solutions, - to communicate with top management of the company
Working mentor 2	Project manager of Youth center CMLC	- to familiarize students with the lifelong learning competencies, - to give advices for the promotion of the project (the funders and contractors – participants of the project team), and - to assist the process of creation of promotional materials - to assist the organization of the promotional activities
Coordinator	Technical assistent of Faculty of logistics	- the management of the projest, and - the coordination of project team

Source: Adapted from Application form of the project (2014) and Final report of the project (2015).

2.3 Impact and benefits of the project

An innovative approach and the cooperation of two quite different professional areas, logistics and technical engineering, gave smart solutions in the project. Innovative approach and the introduction of modern information technologies was needed to overcome the problem of limited resources of the public company.

Mutual cooperation with FL UM and Maribor waterworks results in synergistic effects; a company gains technological innovation, while the faculty gains technological "know-how". With this project FL UM and Maribor waterworks had justified the contract on mutual cooperation, as they both got what they were expected.

FL UM also got new coordinating and managerial competencies as well as references on project work, case studies for teaching process, and quality materials for publications. Both, working as well as teaching menthors also gained new experiences as well as opportunities for new partenerships between all entities (students, industry, higher education institution, social organization). Established partnerships accelerated the motivation of students as potential offsprings of the company as well as intergenerational solidarity (Final report of the project, 2015).

Students upgraded or acquired planned and adventitious competencies represented in Table 2. These competencies will allow professional, responsible and confident behavior in their future work and study. Students made several working reports and a Final working report from which project team members can draw solutions for the implementation even after the project's run-time.

Table 2. Achieved or improved competences of students

Student	Generic competences, skills and knowledge	Specific working competencies
Student 1	- communication skills (internally and externally), - responsibility and development of critical reflection, - project work, - teamwork (interdisciplinary), - creative and innovative integration of theory and practice - results orientation - problem solving	- coherent management of the basic knowledge, - decision-making in the dynamics of logistics systems and logistics processes, - effective problem solving in the field of logistics systems by using the modern scientific methods and procedures (modeling) - understanding and the use of methods of critical analysis and development of theories, and - the ability to applicate theories in solving specific problems - leadership

Student 2 and Student 3		- the use of knowledge in a concrete working environment, - the ability of intensive and continuous use of information and communication technologies and information management systems, - the ability to integrate knowledge from different areas and its installation into concrete applications in the company with a strong logistics function - the ability to analyze, assess and evaluate working processes as well as to update them
Student 4 and Student 5		- the use of knowledge in a concrete working environment, - smart use of software and applications, - the ability to analyze, assess and evaluate working processes as well as to update them
Student 6		- coherent management of the basic knowledge, - the efficient use of resources and the integration of the findings of different studies, - professional criticism, - to make decision on research methods and procedures, - to make decision on the scientific analysis and synthesis, - to choose the appropriate solutions and to assess their implications - leadership

Student 7		- the use and development of methods and tools for modeling, simulation and optimization of processes and devices, - the development and use of modern technologies, - automation of work - the ability to analyze, assess and evaluate working processes as well as to update them, - the organization and management of business processes
Student 8		- the use of modern information and communication technology, - programming of modern mechatronic systems and devices, - the ability to analyze, assess and evaluate working processes as well as to update them
Student 9		- independent and creative problem solving (less complex and medium complex problems), - the introduction of modern technologies, - the ability to analyze, assess and evaluate working processes as well as to update them, - the use and management of modern systems and devices
Student 10		- the ability to analyze, assess and evaluate working processes as well as to update them, - the organizing of simple working processes, - the use and maintenance of modern mechatronic systems and devices

Source: Adapted from Application form of the project (2014) and Final report of the project (2015).

The youth center CMLC gave instructions on promotion activities, where students had learned to communicate with the public and for this reason prepared

different promotional materials: flyer, poster (Figure 1), press releases, publications on websites and social networks, etc. They are also planning to attend promotional events such as Green Celje, International Trade Fair in Celje, and Student Arena in Ljubljana. Students, FL UM, CMLC and the company itself had continuously informed the public via websites about the progress of the project. In the context of project dissemination the impact and benefits of the project are indeed presented in this article to reach interested academic audience.

Figure 1. The promotion poster of the project

Source: Report on promotional activities of the project, 2015.

3. CONCLUSION

Company Maribor waterworks is a public company who had started the project of introducing smart meters, but was faced with lack of transparency in the key processes, such as replacing/installing, repairing and warehousing smart meters, as well as reading the status of drinking water consumption, which for this reason needed to be optimized.

FL UM applied the project and provided project team to solve the problem. All partners of project team gained some benefits from the partnership and work. These benefits are mostly recognized in students' competencies, which reflect in useful knowledge and gained skills. Otherwise, benefits of the project can also be racognized in new scientific instrumentation and methodology, and technological know-how for

faculties, as well as in increasing absorptive capacity of company for scientific and technological problem-solving, as well as in networks and social interactions.

The traditional academic disciplinary structures are often inappropriate for the engagement with the industry, as practical issues are usually interdisciplinary. The ongoing global economic crisis may encourage even stronger expectations in this area (Altbach, Reisberg & Rumbley, 2009, p.163). Logistics science, as an intedisciplinary and multidisciplinary dicsipline, might indeed be recognized as a quite good answer to these issues, as R&D in the field of logistics – namely higher education institutuions – will exploit the given channels of knowledge transfers. However, horizontal channels seems to be important especially for the universities and students, who gain more benefits than industry itself.

The norm of "open innovation" has led research-oriented companies to cooperate with universities. This aspect was reflected in the continued upward trend in industry-funded academic research in OECD countries, although recently government research financial funding increases (Altbach et al., 2009, 157). Financial funding is also possible through diverse sources of funds, that are provided by EU policies. Thus, higher education institutions and the industry should search for appropriate calls to apply for these kind of projects. In the case of work-study projects students' motivation should also be considered – either they get paid, or they establish long-term partnerships with companies. Although the faculty and the company have established long-term partnership, financial funds were provided for five months only, thus students were not able to establish long-term partnership with Maribor waterworks. For this reason, the company should provide their own financial funds to prolong this project to better meet its potential employees, especially because it is a public company, which usually provide less stimulating working environment due to the deficit of public funds, and often therein older workforce is predominant.

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