Engaging students and staff in knowledge exchange

Warsaw University of Technology[1]

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INTRODUCTION

Warsaw University of Technology (WUT) is a public university with 19 faculties, one college, and campuses in Warsaw and Plock. Mazovia region, which surrounds both cities, makes the greatest contribution to Polish GDP, and is home to 20% of Polish enterprises in high and medium-high technology sectors and 28% of companies operating in the "high tech" services.

Innovation in teaching and learning is a priority for WUT's leadership. A Rector's Proxy was established to pilot and mainstream innovative teaching methods. With the support of the Rector's team INFOX, the Creativity Booster of WUT, introduces new teaching methods and novel solutions at central and at faculty levels, and trains academic staff in new teaching methods across all faculties. The tasks assigned to INFOX include also professional support for academic staff to prepare grant applications related to innovative teaching, introduction of organisational structures to support innovation in teaching; and co-operation with WUT partners (industry, regional self-government and city administration) in defining real-world design projects for students to work on.

A second priority for WUT is to support commercialisation of research results. To accomplish this mission WUT created the Centre for Innovation and Technology Transfer Management (CZIiTT), co-funded by the European Regional Development funds. CZIiTT is an interdisciplinary hub responsible for the management of innovation and technology transfer. CZIiTT's primary task is to reinforce the commercialisation of research and development (R&D) through strengthened technology transfer relationships with the business community for WUT and other research centres in Mazovia.

Entrepreneurial teaching and learning

The HEI provides diverse formal learning opportunities to develop entrepreneurial mindsets and skills.

The HEI provides diverse informal learning opportunities and experiences to stimulate the development of entrepreneurial mindsets and skills.

WUT offers a wide range of entrepreneurship education activities, starting with subjects in engineering studies and ending with doctoral studies. Many of these subjects are elective, but there are also compulsory subjects across many WUT faculties (see Annex for a non-exhaustive overview).

The interdisciplinary design projects will become an obligatory part of curriculum for all students in near future on the first/second – year, also thanks to the positive feedbacks received from students. The master's students will deal with more complex real-world problems proposed by business and social partners of WUT.

Efforts are underway by the Rector's team INFOX, the Creativity Booster of WUT and the Department of Young Researchers' Innovation Development to build new brand - the Warsaw Design Factory. WUT joined the Design Factory Global Network in October 2017 and the aim is to jointly organise regular events like: Rat Relay (Global Product Hackathon) and the Design Thinking Week.

At the same time, INFOX continuously develops new initiatives for entrepreneurial training. The following initiatives were started in the academic years 2016/2017 and 2017/18, and raised a lot of interest from students and staff.

The main goal of **Creative Project Semester (CSP)** is to change the traditional entrepreneurial mindset. CSP is not a typical course, it's a once in a lifetime experience for students, employees, and public servants. The participants work with interdisciplinary teams in a creative space, applying Design Thinking and project-based learning methodology. The CSP experience is often reported as transformative and leading to breakthroughs. During the last three years, five CPS courses were offered for a total of 300 students, as well for employees from five companies and a number of public servants from Warsaw City Hall.

Every semester:

- 5 to 8 teams
- each team: 6-8 students
- companies and Warsaw City Hall

Product Development Project (PDP) (part of the Design Factory Global Network, and in collaboration with Aalto University – one-year pilot)

- 2 teams
- 4 students from Poland
- 2 companies

The course is based on problem-based learning and design thinking. Problems are outsourced by the entrepreneur. The project usually includes the following phases: planning, research, creating a concept, making decisions and computer aided design and development. Prototyping, assembly and testing the "solution" are strongly associated with practical experience in learning.

ME310 (within Sugar Network at Stanford University Programme and in collaboration with Polytechnic Institute of Porto – a pilot year)

- 2 teams
- 6 students from Poland (each team 3+3)
- 2 companies

ME310 is a cyclical project developed and co-ordinated by Stanford University. As part of ME310, international teams of students work on the challenges reported and sponsored by business partners. Topics are open and often refer to the vision of future products, services or solutions with ground-breaking potential in a given field.

At the heart of this process is the belief that the introduction of innovation requires a thorough understanding of the needs of users and the environment, and therefore the process is user-oriented, often requiring students to exit from their comfort zone.

SQUAD (part of the Design Factory Global Network, in collaboration with Polytechnic Institute of Porto and New York Design Factory):

- 3 teams
- 6 students from Poland (each team 2+2+2)
- 3 companies

SQUAD is a programme in which undergraduate students develop real projects for companies in the field of digital design and experience design. Industry leaders work together with students on real world challenges, equipping students with the tools and methodologies needed to design and deploy products, services and systems, for the real world.

Another important aspect of INFOX's work is the training of teachers and trainers. INFOX started in 2017 the "Competent Lecturer" programme with the aim to reach more than 200 academic staff by the end of 2020.

Knowledge Exchange and Collaboration

The HEI is committed to collaboration and knowledge exchange with industry, the public sector and society.

Warsaw University of Technology (WUT) co-operates with more than 1 000 national and regional partners and has undertaken more than 500 domestic and international research projects. Mobility initiatives of staff and students have been instrumental for this.

WUT is one of the founding members of PIT, the Polish Institute of Technology (Polski Instytut Technologii). PIT is a virtual consortium of the universities of technology of Lodz, Warsaw, Poznan, Gdansk, the Silesian University of Technology and the Military University of Technology (WAT), the Institute of Fundamental Technological Research of the Polish Academy of Sciences and the Polish Geological Institute – National Research Institute. PIT's strategic goal is to initiate, animate, prepare and implement strategic public-private partnerships at both national and European levels under the Strategic Research and Innovation Agenda (SRIA).

PIT implements joint strategic ventures in the field of creating and developing new technologies in co-operation with business entities and in relation to national and international research and development programmes. PIT is mainly oriented towards advancing high speed railways, security and defence, and space technologies. Thanks to this co-operation between universities and institutes, WUT participates in three projects on scientific research and development for the defense and security of the state. WUT also collaborates on four projects in the field: "New weapons and defense systems in the field of directed energy" under consortia with the Military University of Technology, Wrocław University of Technology and Gdańsk University of Technology, research institutes, and enterprises from the defense industry.

Another area of intensive collaboration is the chemical industry. WUT is a member of the S3Chem Regional Stakeholder Group. The group was co-financed by European Regional Development funds as part of the Regional Innovation Strategy for Mazovia by 2020 (RIS Mazovia).

The Chemical Faculty of WUT leads the Polish Consortium of Electrochemical Energy Storage PolStorEn. The consortium reflects the consolidated scientific community, representatives of

the State Authorities and the batteries industry to tackle challenges of electro-mobility. The founders of the Consortium are: Warsaw University of Technology (Consortium Leader), AGH University of Science and Technology, Institute of Non-Ferrous Metals in Poznań, Gdańsk University of Technology, Poznan University of Technology, Jagiellonian University and Warsaw University. The aim of the consortium is to develop and implement innovative solutions in the field of energy storage. PolStorEn is an indispensable element of an emerging value chain in Poland, aimed at the production of modern cells (including lithium-ion batteries) and supercapacitors. In bridging the science-market gap, PolStorEn partners have developed 56 solutions and product technologies, protected by 31 patents and 29 Polish and foreign patent applications.

Close collaborations between WUT and Lodz University of Technology (TUL) and the Military University of Technology (WAT) have resulted in the creation of the university consortium UT3.

UT3 is involved in several interdisciplinary large research and development (R&D) projects with joint research teams, shared use of laboratories, with the aim to trigger and develop new areas of research. Co-operation also includes joint commercialisation of technical solutions created at the partner universities and the joint support of joint spin-off / start-up companies.

Part of the UT3 agreement is an interdisciplinary study programme in Bioeconomy with seven semesters. Students study for the first three semesters at their home university; then study during the next three semesters for one semester each at one of the three partner universities before they return to their home university for thesis during the final semester. The Bioeconomy degree is a direct response to a growing demand for experts in the field of new regulations and processes in the economy.

The HEI provides opportunities for staff and students to take part in innovative activities with business / the external environment.

To raise awareness and build knowledge, the University of Technology (WUT) introduced a central system of records and archival heritage's for the documents of teaching staff, doctoral

students and all the units of the University, the so-called “Knowledgebase WUT”. An integral part of the system is a repository, which archives in digital full texts of materials documenting ongoing work, including monographs, journal articles, chapters of books and reports. Knowledgebase WUT is also a contact database to facilitate collaboration between WUT scientists and their peers across Poland and in other countries.

WUT has been playing an important role for local economic development in Mazovia and regularly assists the municipal authorities in conducting policies innovation in the capital. One example is the collaboration about the Warsaw Air Index, which started in 2016. The Warsaw Air Index is a system of assessment and forecasting for air pollution, it supports the management of air quality improvement activities such as free public transport, electro-mobility, the development of a zero-emission electric bus project and street washing.

WUT also carries out industrial research and development work outsourced by companies in the framework of the so-called "Fast Track" action introduced by the National Centre for Research and Development. The purpose is to increase the innovativeness of Polish enterprises. Beneficiary companies, often SMEs, need to present a project that is aligned with the "National Smart Specialisation" strategy.

WUT supports academic staff wishing to participate in these activities. Staff on temporary mobility programmes receive part of their salary and are exempted from teaching obligations.

In 2015, WUT organised the "Power Academy". A central actor was the Student Association BEST (Board of European Students of Technology) who collaborated with the Scientific Circle of Power Engineers in the Faculty of Power and Aeronautical Engineering. Participants participated in numerous workshops in the field of energy carried out by experts in the industry.

Young passionate students, PhD candidates and scientists from WUT have formed a team with the Centre for Innovation and Technology Transfer Management (CZIiTT), which is referred to as the Department of Young Researchers’ Innovation Development (DRIMN).

DRIMN collaborates with the WUT Student's Scientific Clubs, the INFOX team, the Students' Self-Government and the Doctoral Council at the Warsaw University of Technology and the Mazovian Scientific Society Platform. Together, they organize workshops, lectures, seminars, and discussions on themes like: "Cryptocurrency", "How to formulate a popular science message for social media", "Creating members of Students Scientific Clubs for the best specialists" or meetings with inspiring personalities, such as Dan Pena.

As part of the World Entrepreneurship Week, WUT through CZIiTT and the Career Office, in collaboration with the Labour Office, conducts workshops for people planning to set up their own business on relevant topics, such as:

- Methods of competition analysis
- Research of clients' needs
- Product / service characteristics
- The financial plan of the venture
- Promotion of the company on the market

The Research and Analyses Department (DBiA) organises as part of the CZIiTT, open seminars for students, PhD students and academics in:

- LegalTech - a combination of legal and modern technologies
- Blockchain approximation of knowledge, technology processes and its use in business
- IP protection of copyrights and know-how
- GETM3 - reports on the activities of the implemented projects

The workshops and seminars on entrepreneurship and knowledge exchange offered by CZIiTT and INFOX attracted the attention of many investors and potential new partners.

Lessons learned and success factors

- Anchoring entrepreneurship and knowledge exchange in WUT through the INFOX team, the Centre for Innovation and Technology Transfer Management (CZIiTT), and the Department of Young Researchers' Innovation Development (DRIMN) CZIiTT has been a very effective approach to build a place for students, PhD candidates, young scientists and established academics looking for ideas, support and networks. These structures also had a positive impact on WUT's attractiveness for investors and potential new partners.

- The networked infrastructure of WUT and the collaboration with other universities in Poland has enhanced the researchers' potential and resulted in a more efficient use of laboratories and research facilities.

- Institutionalisation of the partnerships with other Polish universities (e.g. UT3) around projects and interdisciplinary education programmes (e.g. Bioeconomy) are an effective way to increase student mobility in engineering and doctoral studies. Sharing good practices is a useful educational exercise for all partner universities.

- Nurturing relationships with alumni require dedicated resources but have a good return on investment as alumni often commission research services for their alma mater.

- Tailored educational programmes that meet industry and business partner requirements, such as entrepreneurship courses or IP protection, can launch new partnerships with external partners.

- Funding and other inputs from companies for entrepreneurship education activities makes it much easier to organise the activities and it also facilitates accreditation processes including awarding of ECTS.

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Annex

At the Warsaw University of Technology, many subjects of entrepreneurship education are available, starting with subjects in engineering studies and ending with doctoral studies. Many of these subjects are elective, but there are also compulsory subjects, such as:

- Faculty of Transport and Faculty of Automotive and Construction Machinery Engineering conducts the elective subject *"Innovative Entrepreneurship"*, aiming at students with qualifications to run business;
- Faculty of Power and Aeronautical Engineering conducts two compulsory subjects "*Entrepreneurship in Practice*" and "*Legal Basis of the Company's Activities*", where students acquire knowledge on the basics of management, creating business plans, business etiquette, or legal aspects of business operations;
- At the Faculty of Materials Science and Engineering there are two elective subjects: "*Planning Business Ventures and Innovative Entrepreneurship"* and "*Law of Economic Activities*". The 4th semester students are accustomed to conditions of running a business and legal aspects of business activity;
  Faculty of Civil Engineering offers three elective lectures to students: "*Planning Business Ventures*", *"Business Activity - Sources of Financing*, Regulation of Tax Liabilities", "*Self-employment*", all targeting students with qualifications for running a business. The lectures introduce to rules of starting your own business with emphasis on tax liabilities.
- The Faculty of Geodesy and Cartography runs two elective subjects: "*Design Thinking*" and "*Entrepreneurship*";
- The Faculty of Mathematics and Information Science, as well as most faculties, offer students the subject "*Intellectual Property Protection*", which presents selected issues in the field of copyright and industrial protection.

The Commercialisation and Technology Transfer Department and the CZIITT Innovation Incubator organize workshops on entrepreneurship for PhD students and academics in the field of:

- Creating business models;
- Identification of market needs;
- Product distribution;
- Customer identification;
- Sales strategy and product prices;
- Intellectual protection rights of test results;
- Building relationships with business partners;
- Presenting ideas and results of projects to investor;
- Provisions of investment agreements;
- Speech preparation.

The **Faculty of Management** at the Warsaw University of Technology conducts a series of open scientific seminars at CZIiTT:
"Tradition and Challenges of Management Sciences"
"Challenges of Modeling of the Engineering and Business"
"Entrepreneurship High Technique"

A series of seminars related to innovation are also offered:

- "Project management according to Fujitsu's own methodology";
- "Start-up in the high-tech sector";
- "Internet of Things in Smart Cities";
- “From the scientific circle to the enterprise";
- "Born Global Sector", Education for start-ups";
- "Software in the cloud in the management of the organization";
- "Spin-offs and start-ups in science";
- "Innovative business models";
- "Patenting a start-up ";
- "Start-up as a form of organization - what is it and what is not a start-up?";
- "Sources of financing for start-ups: grants, subsidies, investments or customers?".