REPORT ON

ENTREPRENEURIAL CASES 2019: "ENTREPRENEURSHIP IN ICT" AND "ENTREPRENEURSHIP WITH ICT"

THE ICT ENGINEER OF 21ST CENTURY: MASTERING TECHNICAL COMPETENCIES, MANAGEMENT SKILLS, AND SOCIETAL RESPONSIBILITIES

TEAMSOC21 VALENCIA 2019 MULTIPLIER EVENT

Prepared by:

TeamSoc21
The ICT Engineer of the 21st Century

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Contents

1. INTRODUCTION

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The ICT Engineer of 21st Century: Mastering Technical Competencies, Management Skills, and Societal Responsibilities

(TeamSoc21)

TeamSoc21 logo

TeamSoc21 project URL: *http://sociallab.education/teamsoc21*

TeamSoc21 project at the official ERASMUS+ dissemination platform: *https://goo.gl/SYii7e*

TeamSoc21 project Facebook page: *https://www.facebook.com/teamsoc21*

TeamSoc21 project Instagram page: *https://instagram.com/teamsoc21*

TeamSoc21 project duration: *1 September 2017 – 31 August 2019 (2 years)*

TeamSoc21 project budget: *224,137.00 EUR*

TeamSoc21 project team: *100+ lecturers and students from 12 universities from 8 EU countries*

There is a critical need for educating millions of new *"ICT engineers of the 21st century"* throughout the EU because they will be one of the crucial parts of the companies in the **Industry 4.0 era** which is ahead of us. Surely, such highly skilled professionals will be equally important for both **multinational companies** consisting of hundreds of thousands of employees as well as for establishing hundreds of thousands of new **start-up companies**. The *"The ICT Engineer of the 21st Century: Mastering Technical Competencies, Management Skills, and Societal Responsibilities (TeamSoc21)"* project is a step forward in that direction, taken by consortium of 12 universities from 8 EU countries. The main objective of the TeamSoc21 project is to set up a transnational multidisciplinary intensive study program in the field of ICT-based entrepreneurship.

The TeamSoc21 curricula, which will be available as an open educational resource (OER), consists of four main topic groups:

- **"entrepreneurship"** as a core topic;
- **intercultural topics**, with focus on "multicultural teams";
- **ICT topics**, with focus on "entrepreneurship based on ICT";
- **student start-up projects**, with focus on "entrepreneurial cases on how ICT can contribute to innovative societal development".

„Entrepreneurship" as a core topic of the TeamSoc21 curricula follows a multidisciplinary approach that includes **technology innovation** processes, **business and management** development, **intellectual property**, as well as **technology policy** issues.

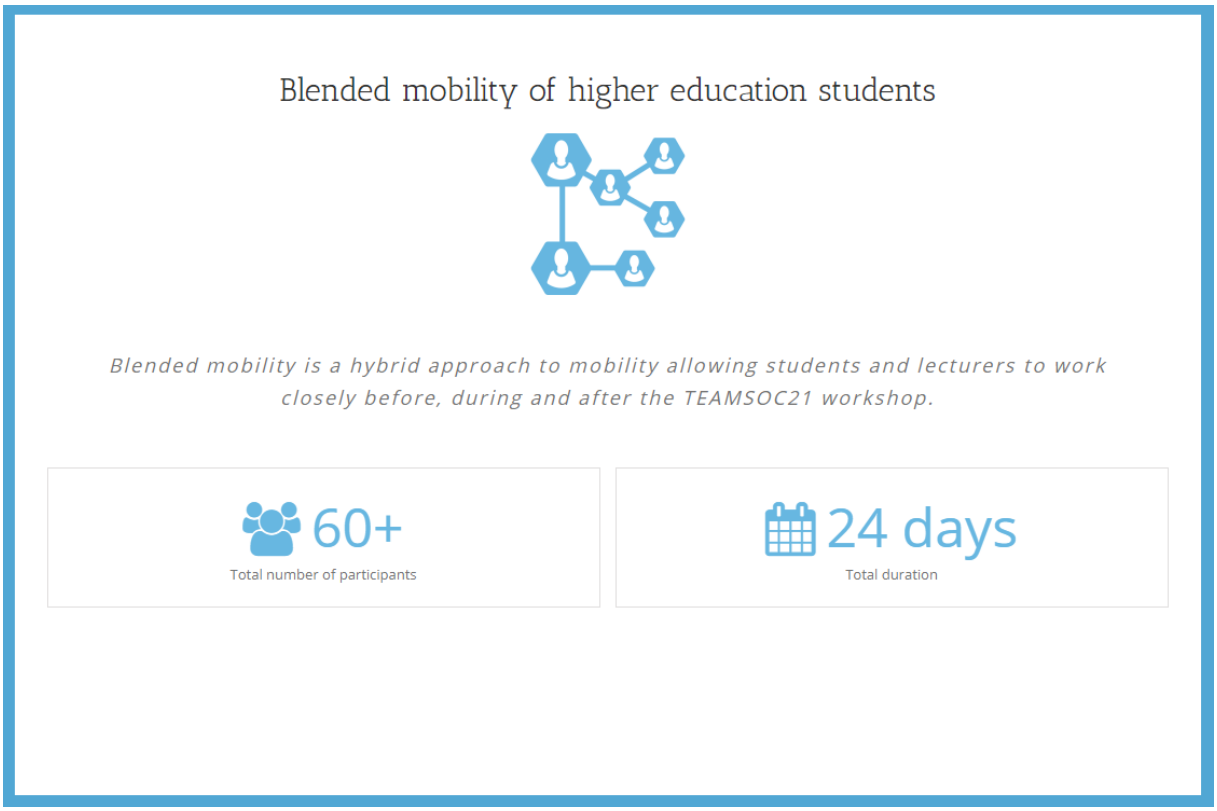
Intercultural part of curriculum uses interactive approach and focuses on **multicultural team** building through exchange of practices from different cultures and by analysing societal challenges from **local, regional and global perspectives**.

ICT part explains why ICT is one of **Key Enabling Technologies**. It includes practical examples tailored specifically for TeamSoc21 providing knowledge/insights into hot ICT topics – **"entrepreneurship in ICT"** and especially **"entrepreneurship with ICT"** – which offer potential solutions for some of the biggest societal challenges.

Student "start-up projects" elaborate entrepreneurial cases related to the role of ICT in responding to societal challenges defined by "Europe 2020"[1] and "Horizon 2020"[2] programs. Entrepreneurial projects will be based on the **"blended" mobility** approach and organized in two phases: (i) **preparatory (virtual mobility)**; and (ii) **execution phase (physical mobility)**. Physical mobility will be implemented through two two-week workshops hosted by partner universities in 2018 (Zagreb) and 2019 (Valencia). Workshop participants will be students and professors from partner universities as well as industry/start-up experts from the hosting country.

[1] https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en

[2] https://ec.europa.eu/programmes/horizon2020



TeamSoc21 blended mobility for students – combining virtual and physical mobility

The TeamSoc21 project aims to achieve the following **Erasmus+ program objectives**:

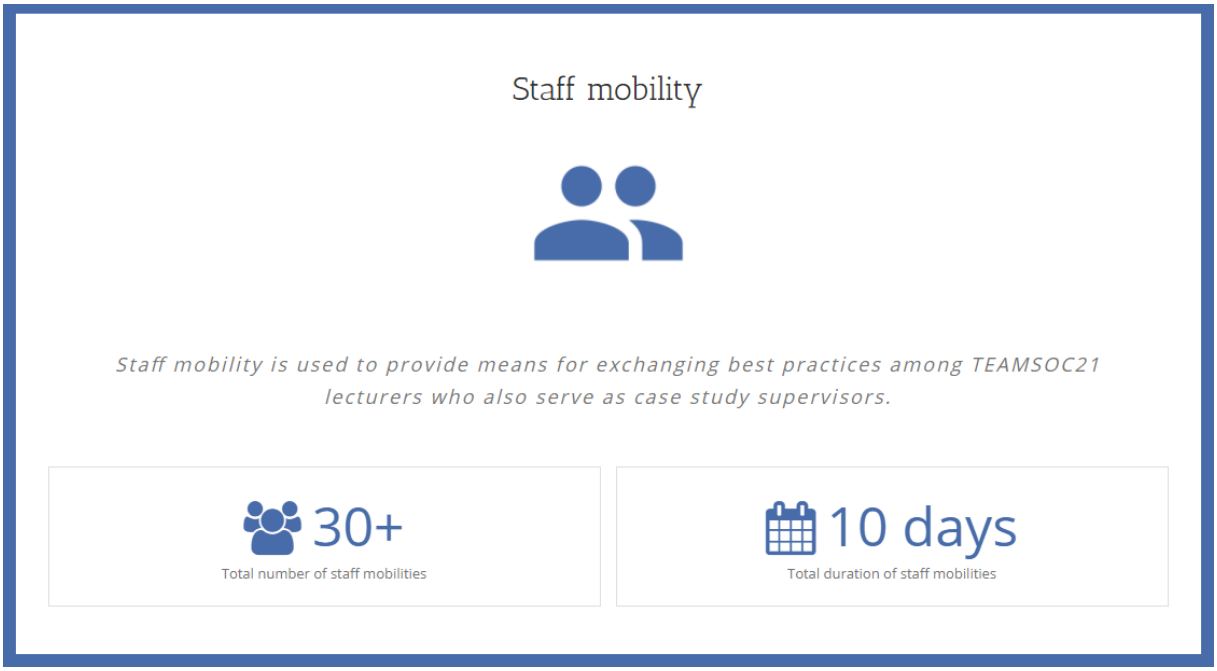
- enhancing **relevance of student knowledge, skills and competences**
  - especially in fields of transversal skills and entrepreneurial experiences for engineering students;
- developing **open and innovative practices for digital era**
  - ICT is one of the central pillars of the project;
- supporting the production and adoption of **open educational resources** (OER);
- pursuing **priorities enlisted in general EU strategies**
  - "Europa 2020, Innovation Union" – "smart, through more effective investments in education, research and innovation");
- pursuing **specific EU strategies**
  - "Horizon 2020" – "all societal challenges will be covered in TeamSoc21 entrepreneurial cases";
  - "Education and Training 2020"[3] – "enhancing creativity and innovation, including entrepreneurship" and "making lifelong learning and mobility a reality").

Additionally, the TeamSoc21 project aims to achieve the **specific Croatian higher education objectives** as well:

[3] http://ec.europa.eu/education/policy/strategic-framework_en

- **internationalization** of higher education;
- enhance **mobility rates**;
- better **link of education with the labour market**.

The first two specific objectives are achieved through enabling Croatian students to participate in Erasmus+ "blended mobility" as well by hosting TeamSoc21 Intensive Program Workshop 2019 in Valencia, while the third specific objective is targeted through the entrepreneurial-oriented cases.



TeamSoc21 staff mobility for lecturers

Implementation of the project will have positive effects on needs of **participating organisations**, **target groups** and **relevant stakeholders** that will be affected by the project:

- *Participating organisations* – "TeamSoc21 universities" – popularization of entrepreneurship among students;
- *Target groups* – "students (and professors) at TEAMSOC 21 universities" – enhance relevance of student (and professor) knowledge, skills and competences; "high-school students from TeamSoc21 Workshop hosting countries" – popularization of STEM studies through Multiplier Events;
- *Relevant stakeholders* – "TeamSoc21 countries" – better link of education with the labour market.

Vedran Podobnik

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TeamSoc21 Project Coordinator

Jurica Babic
University of Zagreb Faculty of Electrical Engineering and Computing
TeamSoc21 Project Manager

2. TEAMSOC21 PARTNERS

International project with 12 members from 8 countries.

University of Zagreb, Faculty of Electrical Engineering and Computing (UNIZG-FER)

University of Zagreb,
Faculty of Electrical Engineering and Computing

CROATIA, Zagreb

Project Coordinator, Steering Committee, Partner

The University of Zagreb (1669), which consists of 34 faculties and academies, is the oldest and biggest university in the South-Eastern Europe. With its comprehensive programmes and over 50,000 full-time students the University of Zagreb is the strongest educational institution in Croatia. Specifically, the Faculty of Electrical Engineering and Computing, through education and innovation in fields of electrical engineering, computer science and information and communication technology, prepares students for leading technological and societal development of Croatia.

How do we innovate at the UNIZG-FER?

As Croatia's leading academic institution, we combine knowledge of our professors, curiosity of our researchers and open-mindedness of our students to foster innovation in our society and economy.

How do we use ICT to tackle societal challenges?

For example, we use ICT to develop innovative mobile applications for persons with complex communication needs (e.g., persons with Down syndrome). For more info check out our ICT-AAC project.

How do we promote intercultural environment?

Intercultural dialogue attracts a lot of attention in Croatia, the youngest member of the EU. This is why at our university we encourage interaction between different cultures, communities and people.

Contact:

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Universitat Politecnica de Valencia (UPV)

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Universitat Politecnica de Valencia

SPAIN, Valencia

Steering Committee, Partner

UPV is a public Higher Education Institution actively involved in international cooperation and mobility projects. UPV hosts over 36,000 students and employs over 5,000 people (teaching, research, administrative, services staff). It is the first technological university in Spain according to international rankings (e.g. Shanghai Ranking of World Universities) and offers 33 undergraduate programmes, 73 official Master's degrees and 28 Doctorate programmes.

How do we innovate at the UPV?

Technical University of Valencia ranks in the top 3 technical universities in Spainand Teelcommunication School provides around 25% of the research at UPV representing only 4% of the staff.

How do we use ICT to tackle societal challenges?

ICT is used widely at UPV, including teaching and reasearch applications, like Sakai facilities, remote teaching, etc.

How do we promote intercultural environment?

UPV is the second university in Spain that welcomes ERASMUS student which gives an idea of the intercultural and plurinational envinroment that the campus provides.

Contact:

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Hochschule fur Telekommunikation Leipzig (HfTL)

HfTL
Hochschule für Telekommunikation Leipzig
University of Applied Sciences

Hochschule fur
Telekommunikation
Leipzig

GERMANY, Leipzig

Steering Committee, Partner

HfTL is a private university under the patronage of the HfTL Trägergesellschaft mbH – a wholly owned subsidiary of Deutsche Telekom AG. It has full recognition by the Ministry of Science and Art of the federal State of Saxony, making it the only corporate-funded private university in Germany. HfTL specializes in academic teaching, research and training in the field of information and communications technologies (ICT) and management.

How do we innovate at the HfTL?

HfTL is the only corporate German university which is specialized on ICT. The study programs are continuously brought in line with the technical and societal development.

How do we use ICT to tackle societal challenges?

As DT as one of the leading ICTelcos set & follows trends in order to facilitate and improve daily life with ICT products, HfTL plays an important role in the relevant field in both education&research.

How do we promote intercultural environment?

HfTL is a globally acknowledged specialized university, offers study programs in ICT for students from all over the world. It is a leading partner of the European network of comparable universities.

Contact:

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Szechenyi Istvan University (SZE)

Szechenyi Istvan University

HUNGARY, Gyor

Steering Committee, Partner

The university serves and will serve the economy and society of the city and the area with the continuous expansion of the educational spectrum. At our university the students can choose subjects from other programmes and can study simultaneously two undergraduate programmes. An economics student can enrich his/her knowledge by listening in on law or engineering subjects. In addition to the twelve thousand students attending the university full time there are five thousand students learning in correspondence courses and distant learning courses. Most recently we have begun to offer e-distant learning courses.

How do we innovate at the SZE?

The University provides a unique and innovative training students with high-level, valuable, professional, and practical education, in addition research activity in the region, which serves primarily the engineering focused production activities.

How do we use ICT to tackle societal challenges?

The University – in accordance with the traditions – pursues predominantly applied research. Particular attention is paid to ICT research activities that are multidisciplinary and interdisciplinary projects, which have a social and economic aspect to them and deal with critical problems.

How do we promote intercultural environment?

The university have established a working educational and research co-operation with more than 150 European institutions of higher education, and industrial partners and with numerous international partnerships outside Europe. The University welcomes cca. 500 foreign students.

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University of Telecommunications and Post (UTP)

University of
Telecommunications and Post

BULGARIA, Sofia

Partner

University of Telecommunications and Post trains students in the area of telecommunication technologies, telecommunication informatics, wireless communications and broadcasting, telecommunication networks as well as management of information technology.

How do we innovate at the UTP?

The University of Telecommunications and Post (UTP) combine knowledge of academic staff and researchers for implementation of innovations in the area of telecommunications, ICT and service management.

How do we use ICT to tackle societal challenges?

UTP develop innovative mobile applications for disabled persons, for smart houses and future trends of implementation of sensor networks for automation and control of industrial processes.

How do we promote intercultural environment?

The University of Telecommunications and Post encourage interaction between different cultures and communities in the area of computer and communication technologies for better social life.

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University of Zilina (UNIZA)

University of Zilina

SLOVAKIA, Zilina

Partner

The University of Zilina was established as the Railway College on 1st September 1953 by the separation from the Czech Technical University in Prague. It has gone through numerous changes during its history. Finally, in 1996, it was renamed from the University of Transport and Communications to the University of Žilina in Žilina. The University as a public university provides education at all three levels of higher education (Bachelor's degree, Engineer/Master's degree and Doctoral degree) in both full-time and part-time forms. Approximately 11 000 students currently study in all forms of study. There are more than 1 500 employees and 650 of them are university teachers.

How do we innovate at the UTP?

We are unique in Slovakia, offering education in transport and communications. Our faculty offers innovative study programs in ICT based on this tradition, but connected to industry requests too.

How do we use ICT to tackle societal challenges?

Our education and research are inter-disciplinary. We are developing apps, networks, hardware answering specific user demand – smart cities, urban transport, health, secure ICT.

How do we promote intercultural environment?

We finished project oriented to internationalization of our university one year before. We have active contact with non-European universities. In last semesters we had students from Taiwan and Brazil.

Contact:

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Institut Mines Telecom – Telecom Bretagne (IMT-TB)

INSTITUT
Mines-Télécom

Institut Mines Telecom –
Telecom Bretagne

FRANCE, Brest

Partner

In the 30 years since its creation, Telecom Bretagne has affirmed itself as a pioneering “Grande École” in education, research and enterprise. It trains multi-discipline engineers able to assume important responsibilities. Recognised for its dynamism and its very substantial international dimension, Telecom Bretagne has partnerships with more than 100 establishments of higher education and research throughout the world. It collaborates with MIT and the Lausanne École Polytechnique Fédérale on the subject of pedagogic innovation. More than a thousand students, from 50 countries, follow engineering courses on two quite exceptional campuses situated at the heart of very active high-technology clusters.

How do we innovate at the IMT-TB?

Founded in 1977, Telecom Bretagne is one of the most prestigious graduate engineering schools in France, at the cutting edge of the Information Technology sector in both research & teaching.

How do we use ICT to tackle societal challenges?

We innovate in all areas of Information Technology, including the Internet of Things, Domotics, Medical Imagery, Intelligent transport & Didactics.

How do we promote intercultural environment?

50% international students, study of two foreign languages; 6 months abroad.

Intercultural Communication and Management courses: students and staff.

Well-established research I/C programme.

Contact:

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Technical University of Kosice (TUKE)

TECHNICKÁ
UNIVERZITA
V KOŠICIACH

Technical University of Kosice

SLOVAKIA, Kosice

Partner

Technical University of Košice (TUKE) was established in 1952. The content of education and research at University includes the entire complex of sciences and economics. The TUKE seeks to maintain a cohesive and interdependent relationship between their teaching, research and service activities with accordance to European state of Art. The TUKE has 9 faculties with 17 030 students and 1880 staff. The TUKE has been the first and so far the only university in Slovakia to meet the criteria of the international standard EN ISO 9001:2000 and it received the quality certificate in the area of providing educational and research processes and enterprise activities within a public university (certification by TÜV SÜD Slovakia s.r.o.).

How do we innovate at the TUKE?

TU support innovations in education (modern ICT infrastructure for students & staff, free wifi everywhere in the campus), excellent research centers. Special support for startups & innovative ideas.

How do we use ICT to tackle societal challenges?

TU have barrier free center for disadvantaged students, e-learning and online documents for students (exams, study results, application forms), internet in the dormitories.

How do we promote intercultural environment?

TU provide support for international students of all 3 levels of study. We have several student organizations: Best, ESN, IAESTE. We organize events for different cultures/nations.

Contact:

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University of Oradea (UO)

University of Oradea

ROMANIA, Oradea

Partner

The mission of the University of Oradea, is to promote knowledge, research and training through partnerships between teachers, students and community. In the last 22 years, the University answered the changes occurred within the national educational policy, demographic changes, requirements of the market economy, local and regional needs and new technologies. All these changes have led to new expectations from students, academic and administrative staff. University of Oradea offers to our students the necessary training to contribute to society development. This training is conducted in 15 faculties which offers a wide range of initial training and postgraduate courses.

How do we innovate at the UO?

University of Oradea's mission, is to promote knowledge, research and training through partnerships between teachers, students and community.

How do we use ICT to tackle societal challenges?

UO is a creative,energetic,active and innovative university.Professors and researchers are very enthusiastic and determined to experience all the new opportunities offered by informational technology.

How do we promote intercultural environment?

UO promotes intercultural dialogue.The city of Oradea ever since the Middle Ages was a cosmopolitan city inhabited by several nationalities what assures a special diversity.

Contact:

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University of Debrecen (UNIDEB)

University of Debrecen

HUNGARY, Debrecen

Partner

University of Debrecen is one of Hungary's five elite-research universities, offering the widest choice of majors in the country for over 29,000 students, including 3,741 international students. UD's 1500 lecturers of 14 faculties endeavour to live up to the elite university status and to provide high quality education. Our goal is to train professionals possessing all necessary skills and knowledge to enter the regional, national, or international labour market with a competitive degree. More than 1000 lecturers with doctoral degrees (PhD), 25 doctoral schools, and the volume of internationally renowned research publications and projects attest to the scientific dominance of the university. 139 of the lecturers and researchers are Doctors of the Hungarian Academy of Sciences and 27 are members of the Academy.

How do we innovate at the UNIDEB?

Strong collaborations are established with companies committed for social challenges. Not only researchers but our students are involved in these activities implying the need of innovative thinking.

How do we use ICT to tackle societal challenges?

Several research groups work on how ICT can be applied in health care systems (e.g. devices and services for health monitoring and prevention, supporting older persons to remain active and healthy).

How do we promote intercultural environment?

Our faculty runs undergraduate and postgraduate programs in English for international students, where also exchange students are welcome. So, real intercultural environment is given for our students.

Contact:

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UNIDEB Team Leader

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Technical University – Sofia (TUS)

Technical University – Sofia

BULGARIA, Sofia

Partner

The Technical University of Sofia is the largest educational and scientific complex in Bulgaria in the field of technical and applied science with an institutional accreditation grade of 9.5 (on the scale of 10) for the period 2012 – 2018. As the first and largest polytechnic center, which supported the establishment of most of the higher technical colleges in the country, it sets the educational standards and national priorities for the development of engineering education and science.

Co-funded by the
Erasmus+ Programme
of the European Union

How do we innovate at the TUS?

We are introducing a system for promoting the students‘ active participation in research and project orientated training for master and PhD students.

How do we use ICT to tackle societal challenges?

Development of algorithms and methods for signal processing in biometric systems and systems using human-computer interface.

How do we promote intercultural environment?

There are three foreign language Faculties: German, French and English providing strong international student and teachers exchange and interaction.

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TUS Team Leader

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University of Osijek The Faculty of Electrical Engineering in Osijek (FERIT)

FERIT
Faculty of Electrical Engineering, Computer Science and Information Technology, J.J. Strossmayer University of Osijek

CROATIA, Osijek

Partner

The Faculty of Electrical Engineering in Osijek is a faculty of the Josip Juraj Strossmayer University of Osijek. Faculty of Electrical Engineering in Osijek has developed into a respectable member of the University of Osijek implementing study programs in electrical engineering (power systems, automation, communications) and computer science (process computing, software and hardware engineering) and related research at the highest level. In 2013 over 2230 students, more than 60% of students at technical studies at Josip Juraj Strossmayer University of Osijek, are studying at the Faculty, out of which 450 entering first year, with 105 post-graduate students, 110 members of teaching staff, out of which 55 full-time professors and lecturers, 32 research assistants, 6 teaching assistants, 17 laboratory technicians and about 30 visiting teachers from other international and Croatian universities and companies.

How do we innovate at the FERIT?

FERIT and Innovations: Projects, Cooperation with Industry, Institutions and SME's.

How do we use ICT to tackle societal challenges?

FERIT and Societal Challenges: STEM Promotion, Mobile/Web Apps for Vulnerable Groups, Labor Market and Environment-friendly and Secure Production.

How do we promote intercultural environment?

FERIT and Intercultural Environment: Mobility, Erasmus+/IAESTE Students/Lecturers, Cross-Border Projects.

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3. TEAMSOC21 2019 REPORTS

Ignac Lovrek
University of Zagreb Faculty of Electrical Engineering and Computing
TEAMSOC21 Steering Committee member
Leader of the Working Group for Preparation of Croatian Science and Technology Strategy

Entrepreneurial Cases 2019: "entrepreneurship in ICT" and "entrepreneurship with ICT"

There are two general challenges for the development of information and communication technology (ICT) in the European Union (EU): a significant increase in the number of scientists and professionals capable of contributing to the research, innovation, production and services, and the new qualifications they need to have, i.e. technical competencies, management skills and societal responsibility. This problem will be presented from two points of view: ICT sector itself and employment in it.

The ICT sector includes manufacturing and service industry, as specified by the Organization for Economic Cooperation and Development (OECD) and implemented in European Union[4]. This classification includes the following sub-sectors:

Manufacturing industry

- Manufacture of electronic components and boards
- Manufacture of computers and peripheral equipment
- Manufacture of communication equipment
- Manufacture of consumer electronics
- Manufacture of magnetic and optical media

Service industry

- Telecommunications
- Repair of communication equipment
- Computer and related activities
    - Computer programming, consultancy and related activities
    - Data processing, hosting and related activities; web portals
    - Software publishing
    - Repair of computers and peripheral equipment

In addition, *ICT Trade industry* includes *Wholesale of computers, computer peripheral equipment and software*, and *Wholesale of electronic and telecommunications equipment and parts*.

About 90% of the economic activities in the EU are related to the service industry, and the remaining about 10% to the manufacturing[5]. Within the service industry, dominant are *Computer and related activities* (~56 %) and *Telecommunications* (~34 %), while *Manufacture of communication equipment* is the key manufacturing activity in the EU (~ 4 %).

It should be noted that Asian economies (China, South Korea and Taiwan) are characterized by a completely different pattern of activities, with a lower share of services and a significantly higher share of manufacturing in the sub-sectors *Manufacture of electronic components and boards, Manufacture of computers and peripheral equipment*, and *Manufacture of consumer electronics*. The US ICT sector is closer to the EU ICT sector, with a higher share of the manufacturing.

[4] NACE Rev.2 Statistical classification of economic activities in the European Communities, Eurostat, European Communities, 2008

[5] Mas M., Fernández de Guevara J., Robledo J.C., López-Cobo M., "The 2017 PREDICT Key Facts Report. An Analysis of ICT R&D in the EU and Beyond", EUR 28594 EN, doi:10.2760/397817

ICT sector represents 4.8% of GDP in the EU and generates 25% of total business expenditure in research and development (R&D)[6]. Further on, ICT sector contributes 20% directly to the overall productivity growth, and an additional 30% to overall investments in ICT in other sectors.
The latest data (available through Eurostat) describing ICT from the employment perspective are presented in Figure 1-3[7].

The total number of ICT specialists in the EU-28 (2007-2017) including the percentage of total employment is shown in Figure 1. It is a workforce of more than 8.4 million professionals representing 3.7% of total employment in EU. The growth is evident but inadequate, as the estimated gap in 2017 is about 1 million.

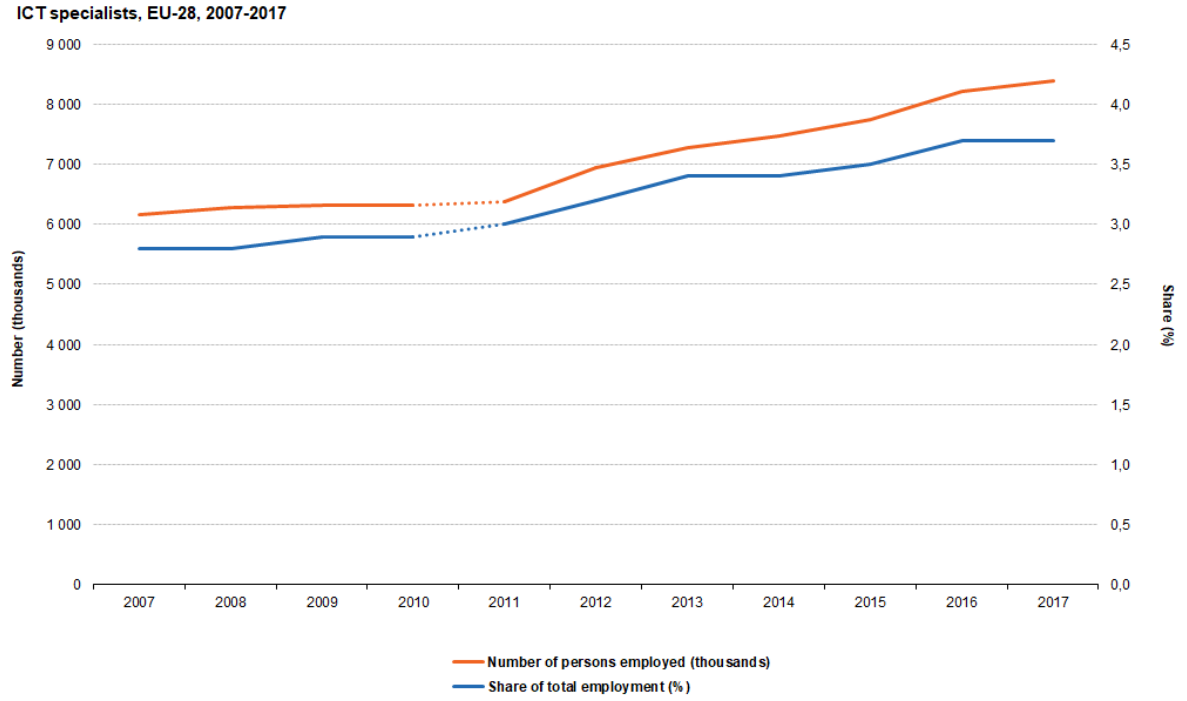

Figure 1 ICT specialists in the EU-28, 2007-2017
(in 1 000s and as a % of total employment)

Regarding qualification structure, the majority of ICT specialists have completed tertiary-level education (university degree), with an EU-28 average of 62,3% (Figure 2). These specialists are ICT engineers!

The number of ICT specialists in Europe (2015) as a % of total employment is shown in Figure 3.

The difference between the countries regarding the level of education and percentage of total employment is significant, among the TeamSoc21 countries as well.

[6] ICT Research & Innovation
(https://ec.europa.eu/programmes/horizon2020/en/area/ict-research-innovation)
[7] ICT specialists in employment
(http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment)

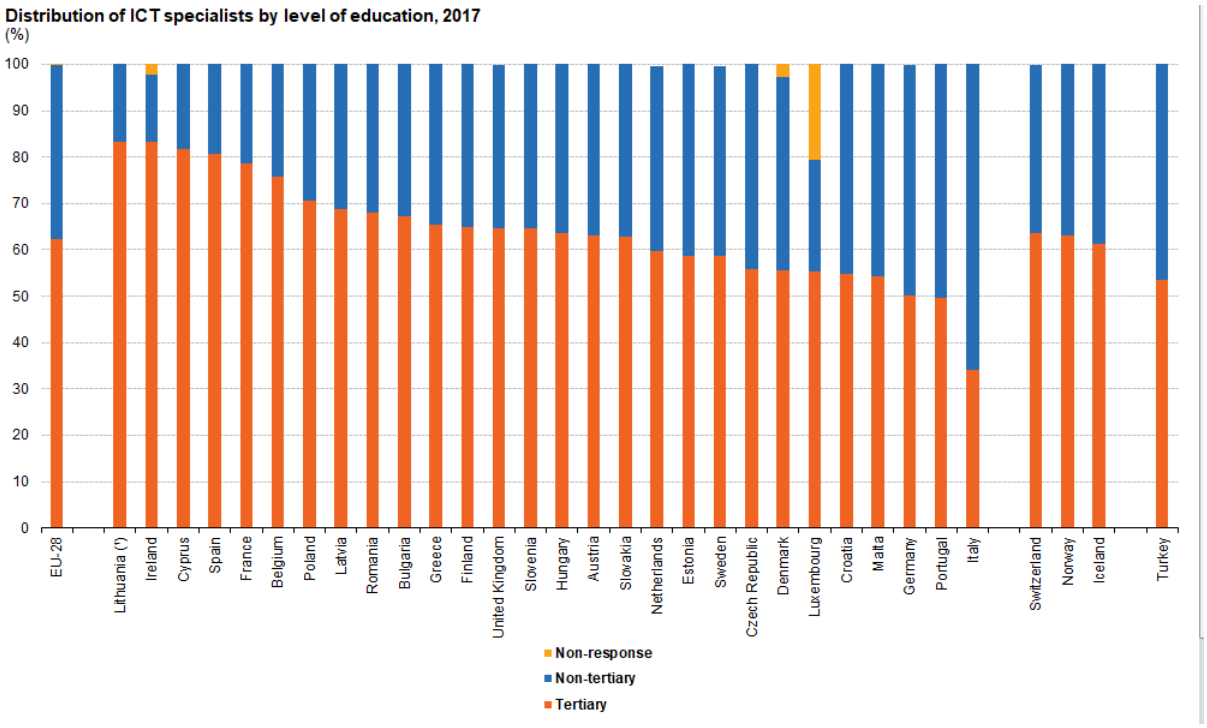

Figure 2 ICT specialists by level of education, 2017

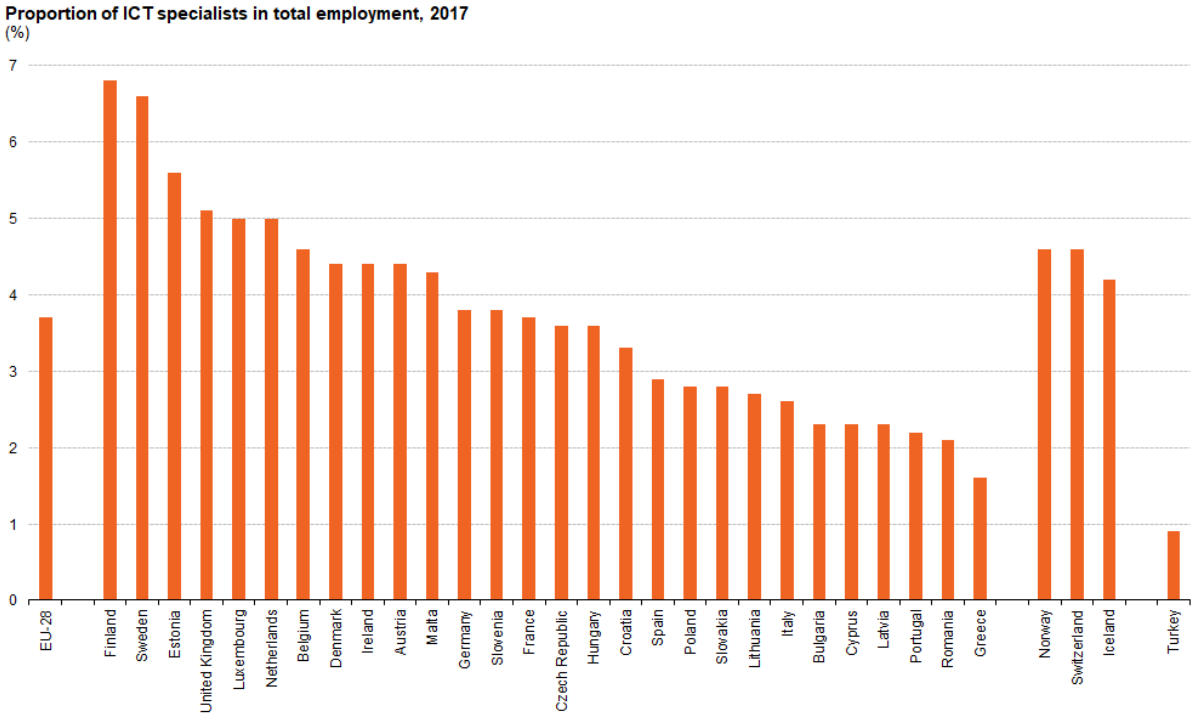

Figure 3 ICT specialists in Europe, 2017
(as a % of total employment)

The lack of ICT professionals, especially ICT engineers, is not the problem of the ICT sector itself, but a general problem. Recall just the digital market, the digital transformation and Industry 4.0. Such role of ICT is recognized in Digital Agenda for Europe and many others European strategic documents, as well as in Horizon 2020 – The framework programme for research and innovation (2014 – 2020). ICT is present in all parts of the Horizon 2020, starting from Excellent science, through Leadership in enabling and industrial technologies (LEIT) up to Societal challenges[8].

Research in the area of Future and Emerging Technologies (FET) is a part of Excellent science. Leadership in enabling and industrial technologies includes Key Enabling Technologies (KET), while Societal challenges comprise the following global societal challenges:

- Health, demographic change and wellbeing (SC1 “Health & Ageing”)
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio economy (SC2 “Food”);
- Secure, clean and efficient energy (SC3 “Energy”)
- Smart, green and integrated transport (SC4 “Transport”)
- Climate action, environment, resource efficiency and raw materials (SC5 “Environment”);
- Europe in a changing world - inclusive, innovative and reflective societies (SC6 “Society”);
- Secure societies - protecting freedom and security of Europe and its citizens (SC7 “Security”).

The focus of ICT-related activities in LEIT in the period 2016-2017[9,10] was on the following topics: a new generation of components and system; advanced computing and cloud computing; future Internet; content technologies and information management; robotics and autonomous systems; micro- and nano-electronic technologies and photonics, as ICT Key Enabling Technologies (KET).

Work programme for 2018-2020 expands the ICT domain with the following topics: technologies for digitising European industry; European Data Infrastructure: High Performance Computing (HPC), Big Data and Cloud technologies; 5G; Next Generation Internet (NGI); as well as with research and innovation related to digitising and transforming European industry and services: digital innovation hubs and platforms, and cybersecurity.

However, the Horizon 2020[11] expands research and innovation to the dimensions of entrepreneurship and business by offering so-called horizontal actions related to innovation and entrepreneurship support, responsibility and creativity (help to startups and prospective tech entrepreneurs to achieve market success, innovation procurement and pre-commercial procurement, responsible ICT-related research and innovation, synergies between artists, creative people and technologists, support to experimentation frameworks and regulatory compliance).

[8] Horizon 2020 in brief – The EU Framework Programme for Research & Innovation, European Union, 2014
[9] A guide to ICT-related activities in WP2016-17
[10] Horizon 2020 Work Programme 2016 – 2017, 5.i. Information and Communication Technologies
[11] Horizon 2020 Work Programme 2018 – 2020, 5.i. Information and Communication Technologies

Mapping of TeamSoc21 programme onto Horizon 2020 is shown in Figure 4.

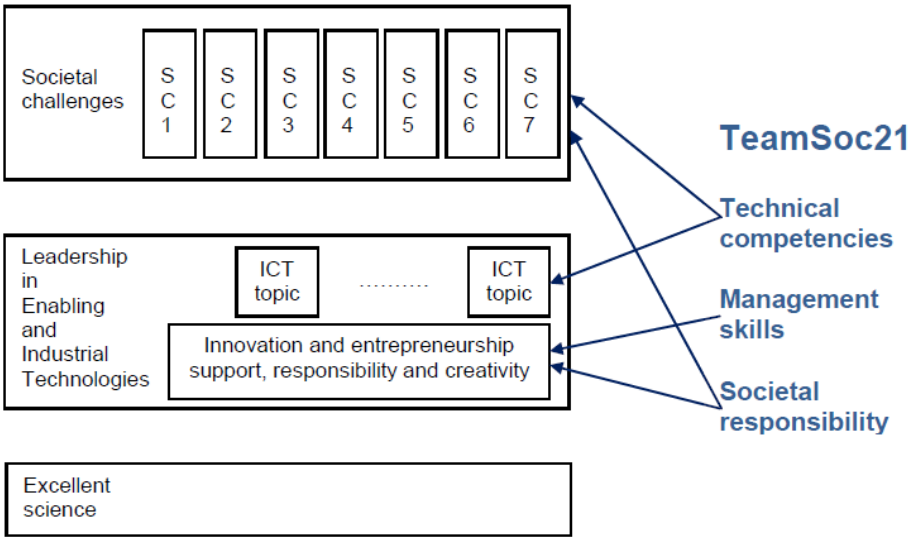

Figure 4 Mapping of Teamsoc21 programme onto Horizon 2020

TeamSoc21 central activity is development of entrepreneurial cases by international student teams. The following 6 cases are prepared for the year 2019:

- Price Automation in Smart Grocery Stores, EC2019-1 (H2020 “Society” challenge);
- Smart Solutions based on Internet of Things, EC2019-2 (H2020 “Energy” challenge);
- Automotive Software Development and the Future of Electromobility, EC2019-3 (H2020 “Transport” challenge);
- Information Security and Quantum Cryptography, EC2019-4 (H2020 “Security” challenge);
- Blockchain Technology in the Healthcare, EC2019-5 (H2020 “Health” challenge);
- 3D-printed Objects: From Simple Gadgets to Implants, EC2019-6 (H2020 “Society” challenge).

Lectures on selected ICT, managerial and social topics will complement teamwork-based entrepreneurial case development. Visits to ICT companies involved in research, development, innovation and provisioning of digital services will be organized in order to provide insight into the industrial perspective of topics covered by TeamSoc21.

As already stated, lack of skilled workforce is a particular problem facing Europe that (will) affect(s) the European research and innovation potential. Part of the problem is an insufficient focus on education in the STEM fields (*Science, Technology, Engineering and Mathematics*) and attracting young people to STEM. This is why STEM studies are considered within TeamSoc21 in the wider context of ICT.

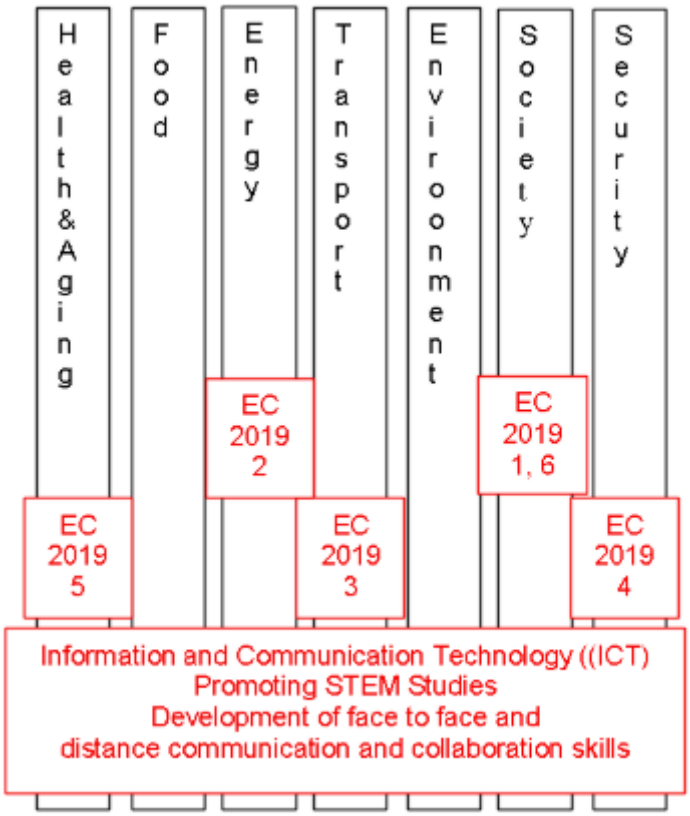

Figure 5 TeamSoc21 entrepreneurial cases, 2019

Ignac Lovrek
University of Zagreb Faculty of Electrical Engineering and Computing
TEAMSOC21 Steering Committee member

Entrepreneurial Case Preparation Process

TeamSoc21 Entrepreneurial Cases for the Valencia 2019 Intensive Program Workshop were selected through the **three-step preparation process**. It is worth mentioning that TeamSoc21 utilizes the same methodology which the preceding INNOSOC project has used for preparing Case Studies. In the first step, which took several months, the *Call for Entrepreneurial Case Proposal* was sent to all 12 TeamSoc21 partners and each partner could propose up to two Entrepreneurial Cases tackling H2020 societal challenges. The proposals should have been done by filling the specially prepared template, which can be found on the following four pages of this document.

TeamSoc21 2019
Entrepreneurial Case proposal

H2020 challenge addressed by the Entrepreneurial Case
(please choose from the drop-down list)

Choose a H2020 challenge

Entrepreneurial Case title
(please insert title – max. 8 words)

Brief description of the Entrepreneurial Case
(please insert 150-250 words)

Entrepreneurial Cases will be "solved" by TEAMSOC21 student teams (4-5 students in each team) who will propose founding a start-up company (or alternatively a new unit within the existing company if this is the most appropriate organizational structure for solving the proposed Entrepreneurial Case) that will produce some new product(s) and/or offer some new service(s). Student teams will have 10 weeks (8 weeks of virtual mobility and 2 weeks of physical mobility) for "solving" the Entrepreneurial Case and they will be supervised by technical, business and societal experts affiliated with TEAMSOC21 consortium members and their partners.

The proposer of this Entrepreneurial Case does not need to provide all three types of experts (i.e., technical, business and societal). For the proposer of the Entrepreneurial Case it is enough to provide at least one expert from at least one domain (technical, business and societal) and the TEAMSOC12 Steering Committee will assign the missing experts to all selected Entrepreneurial Cases from the pool of available TEAMSOC21 experts. On the last page of this document there is a space for the proposer to name one or two experts relevant to the proposed Entrepreneurial Case and willing to be engaged in the TEAMSOC21 activities.

Please describe the Entrepreneurial Case you are proposing. Explain why you think the proposed Entrepreneurial Case is an opportunity/need. Explain why you think it should be discussed from the technical, business, and societal perspective?

What questions do you see as the most relevant from the technical aspect of the proposed Entrepreneurial Case? These are going to be the first "technical" tasks student teams will work on.

The technology, and especially ICT, was in focus of all consortium projects (ESM, SUSCOMTEC, INNOSOC) so it will remain in the focus of the TEAMSOC21 project as well.

Please give examples of questions that focus on the most relevant technical issues of the proposed Entrepreneurial Case, such as technology used, knowledge/skills/expertise of people within the (start-up) engineering team that will work on the technical solution, etc.

EXAMPLE:

- Student teams will need to identify and provide more details about specific technologies which can be used within the Entrepreneurial Case, such as Internet of Things (in case of Entrepreneurial Case dealing with digitalization of food production), 3-D printing (in case of Entrepreneurial Case dealing with digitalization of medical treatments), 5G (in case of Entrepreneurial Case offering a new communication service), etc.

(please insert 3-5 bullets)

What questions do you see as the most relevant from the business aspect of the proposed Entrepreneurial Case? These are going to be the first "business" tasks student teams will work on.
(please insert 3-5 bullets)

The TEAMSOC21 Entrepreneurial Case development will be done according to the "Business Model Canvas" framework, which identifies 9 business model building blocks: Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure. Brief introduction to the framework can be found here: https://www.youtube.com/watch?v=QoAOzMTLP5s and https://www.youtube.com/watch?v=IP0cUBWTgpY.

Please give examples of questions that focus on the most relevant business model building blocks of the proposed Entrepreneurial Case, such as customer segment identification, value proposition definition, etc.

EXAMPLE:

- Student teams will need to identify potential customer segments for products/services they will develop/offer as the result of "solving" the proposed Entrepreneurial Case, such as car drivers (in case of Entrepreneurial Case dealing with digitalization of parking), 18-35 years old females (in case of Entrepreneurial Case dealing with digitalization of birth control), etc.

What questions do you see as the most relevant from the societal aspect of the proposed Entrepreneurial Case? These are going to be the first "societal" tasks student teams will work on.

(please insert 3-5 bullets)

In the TEAMSOC21 project we don't want that students think only about technical and business aspects of start-ups whose foundation they will design, but we want that they also think about the impact founding and functioning of their start-ups will have on a society as a whole.

Please give examples of questions that focus on societal issues such as impact on labour market, customer data protection, working conditions, environment, quality of life, distribution of wealth, etc.

EXAMPLE:

- Student teams will need to provide more details about how Entrepreneurial Case impacts labour market, such as driverless taxis have a negative impact on the need for taxi drivers (in case of Entrepreneurial Case dealing with driverless car-sharing), or how Entrepreneurial Case impacts environment, such as driverless taxis have a positive impact on the environment because they optimize travel routes (in case of Entrepreneurial Case dealing with driverless car-sharing), etc.

Key web-links and/or papers that can be used to understand the Entrepreneurial Case
(please insert 2-3 links and/or papers)

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case
(*please insert 2-3 links*)

TEAMSOC21 partner proposing the Entrepreneurial Case
(please choose from the drop-down list)

Choose a TEAMSOC21 partner

Experts (one or two) from the TEAMSOC21 partner who proposed Entrepreneurial Case development
(please insert info)

Expert 1 name:
Expert 1 e-mail:
Expertise area: technical/business/societal aspects (please mark one or two aspects which are closer to the expert knowledge and experience)
Expert 1 webpage:

(Expert 2 is not mandatory, please erase if you propose only one expert)
Expert 2 name:
Expert 2 e-mail:
Expertise area: technical/business/societal aspects (please mark one or two aspects which are closer to the expert knowledge and experience)
Expert 2 webpage:

Primary contact at the TEAMSOC21 partner proposing the Entrepreneurial Case
(please insert contact info)

Name:
E-mail:

After all Entrepreneurial Case proposals were collected, the TeamSoc21 Steering Committee analysed all received proposals and selected six Entrepreneurial Cases for the Valencia 2019 Intensive Program Workshop. Some of selected Entrepreneurial Cases were result of merging two related or complementary proposals received from TeamSoc21 lecturers from different universities

In the second step of the TeamSoc21 Entrepreneurial Case preparation process, TeamSoc21 lecturers that proposed selected Entrepreneurial Cases were asked to extend their proposals by filling the specially prepared template, which can be found on the following five pages of this document.

TeamSoc21 2019 Entrepreneurial Case proposal
(extended version)

Entrepreneurial Case title
(please insert title – max. 8 words)

Keywords
(please add 3-8 keywords separated by a semicolon)

H2020 challenge addressed by the Entrepreneurial Case
(please choose from the drop-down list)

Choose a H2020 challenge

Brief description of the Entrepreneurial Case

Entrepreneurial Cases will be "solved" by TEAMSOC21 student teams (4-5 students in each team) who will propose founding a start-up company (or alternatively a new unit within the existing company if this is the most appropriate organizational structure for solving the proposed Entrepreneurial Case) that will produce some new product(s) and/or offer some new service(s). Student teams will have 10 weeks (8 weeks of virtual mobility and 2 weeks of physical mobility) for "solving" the Entrepreneurial Case and they will be supervised by technical, business and societal experts affiliated with TEAMSOC21 consortium members and their partners.

The proposer of this Entrepreneurial Case does not need to provide all three types of experts (i.e., technical, business and societal). For the proposer of the Entrepreneurial Case it is enough to provide at least one expert from at least one domain (technical, business and societal) and the TEAMSOC12 Steering Committee will assign the missing experts to all selected Entrepreneurial Cases from the pool of available TEAMSOC21 experts. On the last page of this document there is a space for the proposer to name one or two experts relevant to the proposed Entrepreneurial Case and willing to be engaged in the TEAMSOC21 activities.

Please describe the Entrepreneurial Case you are proposing. Explain why you think the proposed Entrepreneurial Case is an opportunity/need. Explain why you think it should be discussed from the technical, business, and societal perspective?

(please insert 150-250 words)

What questions do you see as the most relevant from the technical aspect of the proposed Entrepreneurial Case? These are going to be the first "technical" tasks student teams will work on.

The technology, and especially ICT, was in focus of all consortium projects (ESM, SUSCOMTEC, INNOSOC) so it will remain in the focus of the TEAMSOC21 project as well.

Please give examples of questions that focus on the most relevant technical issues of the proposed Entrepreneurial Case, such as technology used, knowledge/skills/expertise of people within the (start-up) engineering team that will work on the technical solution, etc.

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(please insert 3-5 bullets)

What questions do you see as the most relevant from the business aspect of the proposed Entrepreneurial Case? These are going to be the first "business" tasks student teams will work on.
(please insert 3-5 bullets)

The TEAMSOC21 Entrepreneurial Case development will be done according to the "Business Model Canvas" framework, which identifies 9 business model building blocks: Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure. Brief introduction to the framework can be found here: https://www.youtube.com/watch?v=QoAOzMTLP5s and https://www.youtube.com/watch?v=IP0cUBWTgpY.

Please give examples of questions that focus on the most relevant business model building blocks of the proposed Entrepreneurial Case, such as customer segment identification, value proposition definition, etc.

EXAMPLE:

- Student teams will need to identify potential customer segments for products/services they will develop/offer as the result of "solving" the proposed Entrepreneurial Case, such as car drivers (in case of Entrepreneurial Case dealing with digitalization of parking), 18-35 years old females (in case of Entrepreneurial Case dealing with digitalization of birth control), etc.

What questions do you see as the most relevant from the societal aspect of the proposed Entrepreneurial Case? These are going to be the first "societal" tasks student teams will work on.

(please insert 3-5 bullets)

In the TEAMSOC21 project we don't want that students think only about technical and business aspects of start-ups whose foundation they will design, but we want that they also think about the impact founding and functioning of their start-ups will have on a society as a whole.

Please give examples of questions that focus on societal issues such as impact on labour market, customer data protection, working conditions, environment, quality of life, distribution of wealth, etc.

EXAMPLE:

- Student teams will need to provide more details about how Entrepreneurial Case impacts labour market, such as driverless taxis have a negative impact on the need for taxi drivers (in case of Entrepreneurial Case dealing with driverless car-sharing), or how Entrepreneurial Case impacts environment, such as driverless taxis have a positive impact on the environment because they optimize travel routes (in case of Entrepreneurial Case dealing with driverless car-sharing), etc.

Key web-links and/or papers that can be used to understand the Entrepreneurial Case
(please insert 5-10 links and/or papers)

This section should give main references connected to the Entrepreneurial Case. The role of these references is twofold: i) they support and or elaborate in more details statements given in the remainder of this document; and ii) they are initial reading list for students. Please provide citations according to the IEEE Citation Reference guidelines (http://www.ieee.org/documents/ieeecitationref.pdf). All references should be cited at least once in the text in the remainder of this document by inserting "[x]" mark in the text, where "x" is the number of the reference (same as when you write scientific papers).

[1] Reference 1
[2] Reference 2
…
[10] Reference 10

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case
(*please insert 2-3 company names and links to company websites*)

- Company/Start-up 1 name: link
- Company/Start-up 2 name: link
- Company/Start-up 3 name: link

Knowledge and skills needed for developing the Entrepreneurial Case
(please add 3-8 knowledge units and/or skills separated by a semicolon)

Four students (from different partner universities) will be allocated to the each Case Study. Students will bid for Case Studies in the process of student allocation. Students will rank their choices of Case Studies based on two criteria: i) interest for the Case Study topic (students will determine their interest for the topic based on the Case Study description given in this document); and ii) knowledge and skills needed for developing specific Case Study (students will determine their capability for working on the Case Study based on the list of knowledge and skills given in this section). We differentiate two categories of knowledge and skills: "prerequisite" (P) and "desirable, but not necessary" (D). Please mark each knowledge unit and skill with one of these categories (i.e., (P) or (D)).

Example of a knowledge unit: "TCP/IP protocol stack" (P); "wearables for e-health" (D)
Example of a skill: "statistical analysis in the language/tool R" (P); "web-page programming" (D)

Figures describing this Entrepreneurial Case (please insert 2-3 print quality figures; we are going to use these figures in our publications (web/brochures) so please be careful about copyright – insert only figures which are not copyrighted or provide us with source citation or whatever information which allows us to publish these photos (e.g. inserted photo is a photo taken by you and showing your lab); give a one line caption for every inserted figure)

INSERT FIGURE HERE
Figure 1. One line caption

INSERT FIGURE HERE
Figure 2. One line caption

INSERT FIGURE HERE
Figure 3. One line caption

TEAMSOC21 partner proposing the Entrepreneurial Case
(please choose from the drop-down list)

Choose a TEAMSOC21 partner

Primary contact at the TEAMSOC21 partner proposing the Entrepreneurial Case
(please insert contact info)

Name: *E-mail*:

Experts who will coordinate the Entrepreneurial Case development
(info will be inserted by the TeamSoc21 Steering Committee

Expert 1 name: *Expert 1 e-mail*: Expertise area: technical/business/societal aspects *Expert 2 name*: *Expert 2 e-mail*: Expertise area: technical/business/societal aspects *Expert 3 name*: *Expert 3 e-mail*: Expertise area: technical/business/societal aspects *Expert 4 name*: *Expert 4 e-mail*: Expertise area: technical/business/societal aspects *Expert 5 name*: *Expert 5 e-mail*: Expertise area: technical/business/societal aspects *Expert 6 name*: *Expert 6 e-mail*: Expertise area: technical/business/societal aspects

In the last step, which took place January-February 2019, of the TeamSoc21 Entrepreneurial Case preparation process, TeamSoc21 Steering Committee members finalized the preparation of each Entrepreneurial Case selected for the Valencia 2019 Intensive Program Workshops.

Entrepreneurial Cases were published online and the process of TeamSoc21 students allocation to Entrepreneurial Cases has started. On average, four TeamSoc21 students are grouped together to work on Entrepreneurial Case development through their TeamSoc21 blended mobility. Each student group (of total 10 groups) will be supervised by one or more TeamSoc21 lecturers who are experts in technical, business, and societal aspects of the Entrepreneurial Case. Final results of student work will be presented during Valencia 2019 Intensive Program Workshop in early May 2019 (Valencia).

Detailed description of the six TeamSoc21 2019 Entrepreneurial Cases is given in the next section of this report, as well as they are available online (http://sociallab.fer.hr/teamsoc21/case-studies/valencia-2019-entrepreneurial-cases/).

4. TEAMSOC21 21 ENTREPRENEURIAL CASES

Smart Solutions based on Internet of Things

Case study URL: https://urlzs.com/fnW8v

Authors: Mate Liszi, Pavle Skocir

Keywords: Smart meters, IoT platforms, IoT protocols, interoperability

H2020 challenge addressed by the Entrepreneurial Case: Secure, clean and efficient energy

Description of Entrepreneurial Case:

IoT (Internet of Things) technology can facilitate the operation of utility providers (electricity, gas, water) [1]. The public utility providers usually have units for consumption measurement (meters) at each consumer location without the possibility to read the consumption information remotely. This implies a vast number of meters that need to be physically frequented in regular intervals by the provider to acquire consumption information. With IoT, a provider can acquire the measurement information remotely, without the need to physically access each meter or without the need for consumers to read the consumption values themselves and send the data to providers. These units are referred to as smart meters [2]. The deployment of smart meters increases the comfort of consumers since they do not have to take part in consumption reading and delivery process. Remote meter reading can be performed at a short distance, e.g., from a moving car on the street with a receiver, or at long distance by using stationary base stations [4]. Various technologies can be used for connecting smart meters with utility provider charging systems.

Questions that need answers during the Entrepreneurial Case development

Technical aspect

Students should analyse the current solutions in the area of smart metering. The following technological aspects should be evaluated:

- The hardware used for smart meters [5]
- Communication technologies, protocols used by smart meters [5]
- The overall system architecture (placement of gateways, databases, available applications and their functionalities) [3]

IoT platforms for storage and analysis of smart metering data [6]

Smart metering data can be stored on different IoT platforms, e.g., on different platforms used by various national utility providers. Sometimes it is needed for certain applications (e.g., national

regulators) to use information from different IoT platforms. The symbIoTe framework can facilitate access to data stored on different IoT platforms [7]. What needs to be done to integrate smart metering data from various platforms to the symbIoTe framework [8]?

Business aspect

- Student teams will need to analyse the current coverage of smart meters in the European countries and try to determine the areas which remain uncovered by smart meters.
- Smart meters can be used for more than just reporting on energy consumption [9]. Energy consumption information can be spread in one country over different smart metering platforms. Interoperability between these platforms is needed both within the national borders and between different countries. Why is interoperability between these different systems needed? Think not only about energy consumption measurements, but also other utilities (water, gas, etc.)
- symbIoTe project introduces the notion of platform federations [10]. Can this interoperability model be applied for some of the advanced usage scenarios of smart meters?

Social aspect

- Students need to analyse how the introduction of smart meters influences the labour market, i.e., how would it influence on the jobs of employees responsible for acquiring meter reading?
- What is the impact of applying a smart metering system at a public utility company in your country? What are your experiences about gathering consumption information (of the consumed gas, electricity, etc.?)? How can this solution influence the quality of life of the end consumers?
- What is the impact of determining accurate statistical reports about the consumed energy? Can this help in optimizing energy consumption?
- Does the data shared by smart metering solution need to be protected? What can be implied if the transfer of utility-related information is not secure?

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] Telenor connexion: “IoT trends in the utilities industry”, URL: https://www.telenorconnexion.com/iot-trends-in-the-utilities-smart-metering-industry-what-you-should-know/

[2] Q. Sun et al., "A Comprehensive Review of Smart Energy Meters in Intelligent Energy Networks," in IEEE Internet of Things Journal, vol. 3, no. 4, pp. 464-479, 2016.

[3] J. Lloret, J. Tomas, A. Canovas and L. Parra, "An Integrated IoT Architecture for Smart Metering," in IEEE Communications Magazine, vol. 54, no. 12, pp. 50-57, 2016.

[4] Z. Fan et al., "Smart Grid Communications: Overview of Research Challenges, Solutions, and Standardization Activities," in IEEE Communications Surveys & Tutorials, vol. 15, no. 1, pp. 21-38, 2013.

[5] W. R. Kintzel, M. M. Mattos, A. R. Borges, “Hardware Design of a Smart Meter Communication Interface for Smart Grids”, in Conference on Complex, Intelligent, and Software Intensive Systems, book series Advances in Intelligent Systems and Computing, vol. 611, pp. 371-383, 2017.

[6] A. Berouine, F. Lachhab, Y. N. Malek, M. Bakhouya and R. Ouladsine, "A smart metering platform using big data and IoT technologies" 2017 3rd International Conference of Cloud Computing Technologies and Applications (CloudTech), Rabat, pp. 1-6, 2017

[7] I. P. Žarko, “Creating cooperative IoT platforms with symbIoTe”, symbIoTe Technical blog, 2017, URL: https://www.symbiote-h2020.eu/blog/2017/02/17/creating-cooperative-iot-platforms-with-symbiote/

[8] P. Skočir, “How to make an IoT platform symbIoTe enabled”, symbIoTe Technical blog, 2017, URL: https://www.symbiote-h2020.eu/blog/2017/11/03/how-to-make-an-iot-platform-symbiote-enabled/

[9] Ericsson: “Making the metering smart – A transformation towards smart cities”, presentation, URL: https://www.ericsson.hr/documents/20181/21930/Making_the_metering_smart.pdf/d6fd16e2-4dfa-4da0-b7d2-6b3ef223334f?t=1496751016953

[10] G. Carrozzo, “Platform Federations: Collaboration by symbIoTe-enabled IoT platforms”, symbIoTe Technical blog, 2017, URL: https://www.symbiote-h2020.eu/blog/2017/12/20/platform-federations-collaboration-by-symbiote-enabled-iot-platforms/

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Smart Metering Pro: https://devicehub.net/smart-metering-pro

Open Smart Grid Platform: https://opensmartgridplatform.org

RIZ Transmitters Automatic meter reading: http://www.riz.hr/en/smart-meters/software-solutions/riz-amr-system.html

Knowledge and skills needed for developing the Entrepreneurial Case

(“prerequisite” (P) and “desirable, but not necessary” (D))

- Fundamentals of software design and architecture (P)
- Internet of Things (D)
- Communication technologies (LoRa, NB-IoT, LTE-M) (D)
- Hardware for analysing smart meters (D)

Figures describing this Entrepreneurial Case

Figure 1. Smart meters

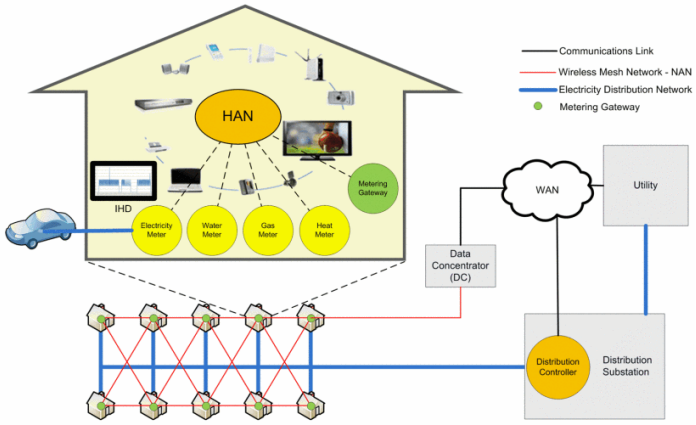

Figure 2. Smart metering architecture [4]

Blockchain Technology in the Healthcare

Case study URL: https://urlzs.com/fnW8v

Authors: Peter Marton, Eva Malichova, Emese Tokarcikova

Keywords: blockchain, technology, healthcare, health data

H2020 challenge addressed by the Entrepreneurial Case: Health, demographic change and wellbeing

Description of Entrepreneurial Case:

Generally, the level of healthcare is an important determinant of wellbeing of people all around the world. Fragmented data, incomplete records, lack of interoperability, delayed communication, protection of privacy, etc. increase the costs of healthcare every year and create an urgent request for change.

New technology platforms, which enable secure communication, use and exchange of data among healthcare organizations and their stakeholders, have the potential to transform healthcare. One of them, the Blockchain technology, can improve the efficiency and effectiveness of healthcare services. According to the analysis performed by Deloitte [1], Blockchain is placing the patient at the center of the healthcare ecosystem and it increases the security, privacy, and interoperability of health data. This technology could provide a new model for health information exchanges by making electronic medical records more efficient, disintermediated and secure [2][3]. Also, the Blockchain technology could offer a framework for patient secure interaction with stakeholders in healthcare system [4], as well as help to improve care coordination and supplies of medicines, create the possibility of remote and autonomous diagnosing, and reduce costs.

The entrepreneurial case can be realized through the identification of those specific healthcare areas where the usage of Blockchain could generate and add value, which results in the success of the enterprise. Use of the proposed solution needs to be discussed from several perspectives – technical, business and societal, so that possible strengths and weaknesses of this concept can be identified.

Questions that need answers during the Entrepreneurial Case development

Technical aspect

Blockchain technology is a type of an open-distributed ledge allowing digital information to be distributed but not copied. It is a peer-to-peer network without a central server. The database contains data about transactions between users. Transactions are verified by the miners and information is distributed on each network member host [5].

Even though the Blockchain was invented to serve as the public transaction ledger of the digital currency Bitcoin, this technology has several applications also in other fields as a secure and cost-effective method for management of digital transactions of all types.

Within the Entrepreneurial Case, the student team should:

- identify areas of healthcare (subject, relations, criteria etc.),
- provide more details and suggestions for potential implementation of Blockchain technology in the field of healthcare,
- specify the requirements and circumstances of the solution.

Business aspect

When you want to create a successful business strategy for a start-up to fulfil the idea, your student team as a business entity needs to offer something that creates new value for the customers.

Your student team should brainstorm and find relevant answers to questions as:

- What is the added value of your product?
- Which segments of customers are you creating value for and what are their characteristics, needs, expectations, possibilities and options?
- Which marketing tools are suitable for approaching potential customers?
- What is your strategy for the selling and distribution of your product?
- Who are your potential business partners?
- What are the costs of your solution and your pricing strategy?

Similarly, with the application of the CANVAS business model, further develop the areas such as the Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships and the Cost Structure [6].

Social aspect

Student teams will need to identify positive or negative impacts of the application of Blockchain in healthcare on society and answer questions as:

How can you spread information about Blockchain and its advantages in healthcare among people?

How can you measure and describe social impacts of your solution?

How can you improve positive influence of your solution on society as a whole?

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] Deloitte, "Blockchain: Opportunities for health care. A new model for health information exchanges,"Deloitte. [Online]. Available: https://www2.deloitte.com/us/en/pages/public-sector/articles/blockchain-opportunities-for-health-care.html. [Accessed: Jan. 15, 2019].

[2] Abdullah Al Omar et al., "Privacy-friendly platform for healthcare data in cloud based on blockchain environment", Future Generation Computer Systems, Vol.95, p. 511-521. Available: https://doi.org/10.1016/j.future.2018.12.044. [Accessed: Jan. 15, 2019].

[3] Zhang, P., Schmidt, D.C., White, J and Lenz, G.,"Chapter One - Blockchain Technology Use Cases in Healthcare," Advances in Computers, Vol.11, p. 1-41. Available: https://doi.org/10.1016/bs.adcom.2018.03.006 [Accessed: Jan. 15, 2019].

[4] Gordon, W.J. and Catalinide, C., "Blockchain technology for healthcare: Facilitating the transition to patient-driven interoperability," Computational and Structural Biotechnology Journal, Vol. 16, p. 224-230. Available: https://doi.org/10.1016/j.csbj.2018.06.003. [Accessed: Jan. 15, 2019].

[5] Koshechkin K.A., Klimenko G.S., Ryabkov I.V. and Kozhin P.B., „Scope for the Application of Blockchain in the Public Healthcare of the Russian Federation", Procedia Computer Science, Vol. 126, p. 1323 – 1328. Available: https://doi.org/10.1016/j.procs.2018.08.082. [Accessed: Jan. 15, 2019].

[6] Joyce, A. and Paquin, R.L., "The triple layered business model canvas: A tool to design more sustainable business models,"Journal of Cleaner Production, Vol. 135, p. 1474 – 1486. Available: https://doi.org/10.1016/j.jclepro.2016.06.067. [Accessed: Jan. 15, 2019].

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Patientory: https://patientory.com
PokitDok: https://pokitdok.com
GEM: https://enterprise.gem.co/health
Guardtime: https://guardtime.com
Chronicled: https://www.chronicled.com

Knowledge and skills needed for developing the Entrepreneurial Case

- Technical and programming knowledge (P)
- Interest in new technologies (P)
- Analytical skills (P)
- Basics of entrepreneurship (P)
- Basics of management and marketing (D)
- Presentation skills (D)
- Ability to work in a team (D)

Figures describing this Entrepreneurial Case

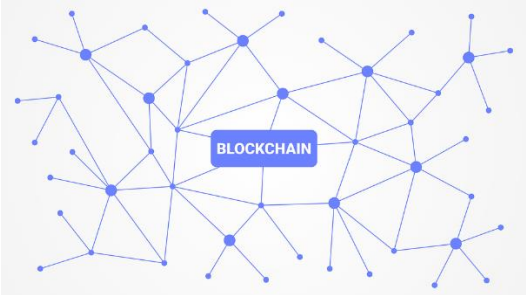

Figure 1. Blockchain

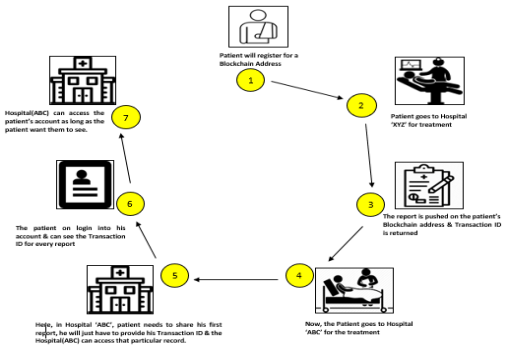

Figure 2. Blockchain in Healthcare

Information Security and Quantum Cryptography

Case study URL: https://urlzs.com/6Uixp

Authors: Maria Nenova

Keywords: cryptographic protocols; information theory; quantum cryptography; quantum computing

H2020 challenge addressed by the Entrepreneurial Case: cryptographic protocols; information theory; quantum cryptography; quantum computing

Description of Entrepreneurial Case:

Security of information is one of the main tasks in our days. The desire for protection of health records, personal data, and communications is a great opportunity to advance the technology for that. One of the most effective and reliable ways to protect data spread through a communication media is the use cryptography. Classical crypto methods are symmetric and asymmetric ones. The PKI is also a developing area.

The next level of development in cryptography – quantum cryptography – is a big challenge for universities, researchers, technical labs (it started there), organizations and industry (lasers, equipment). This new area takes in a different level the protection of data. The basis is not a mathematical, but all the idea is based on the specific feature of photons – the polarization.

Questions that need answers during the Entrepreneurial Case development

Technical aspect

Student teams will need to identify and provide more details about specific technologies which can be used within quantum cryptography:

- What are the main issues in the security of information from engineering point of view?
- What is the basis of cryptography, main challenges and algorithms to implement it?
- What models of a whole quantum cryptosystem (blocks and subsystems) exist?
- What is the technology behind the quantum cryptography?
- What equipment is needed to perform it?
- What are quantum cryptography protocols?
- What are quantum computers?
- What protocols are used in quantum computing?
- Which attacks and vulnerabilities against the cryptosystem and the cryptoprotocol exist?

Business aspect

- Technology used – prices and curent situation on the market for main parts of the quantum machines;
- Cost of the devices and elements for quantum computing and cryptosystems;
- Existing business models in the domain of cryptosystems.

Social aspect

- What will be the impact of such a big change in the cryptography system model?
- What will be the impact on the market, for example of computers?
- How can one enterprise for quantum computers or quantum cryptosystem components work?
- What will be the qualification of the people and working environment?
- What will hapen with the digital world taking into account described changes in the domain of cryptosystems?

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] https://www.plixer.com/blog/network-security/quantum-cryptography-explained

[2] Charles H. Bennett, Gilles Brassard, “Quantum cryptography: Public key distribution and coin tossing”, https://doi.org/10.1016/j.tcs.2014.05.025;

[3] Accenture Labs and 1QBit Work with Biogen to Apply Quantum Computing to Accelerate Drug Discovery | Accenture Newsroom". newsroom.accenture.com. Retrieved 2017-10-04.

[4] Tovey, Alan (2015-12-26). "Airbus's quantum computing brings Silicon Valley to the Welsh Valleys". ISSN 0307-1235. Retrieved 2017-11-02.

[5] Horwitz, Josh. "Alibaba is plowing $15 billion into R&D with seven new research labs worldwide". Quartz. Retrieved 2017-11-01.

[6] Jian Li, Na Li, Yu Zhang, Shuang Wen, Wei Du, Wei Chen, Wenping Ma, “A Survey on Quantum Cryptography”, Chinese Journal of Electronics (Volume: 27 , Issue: 2 , 3 2018), Page(s): 223 – 228, ISSN: 1022-4653.

[7] Omer K. Jasim, Safia Abbas, El-Sayed M. El-Horbaty, Abdel-Badeeh M. Salem, Cloud Computing Cryptography "State-of-the-Art", (DOI): doi.org/10.5281/zenodo.1088898.

[8] Richard J. Hughes, D. M. Alde, P. Dyer, G. G. Luther, G. L. Morgan & M. Schauer (1995) Quantum cryptography, Contemporary Physics, 36:3, 149-163, DOI: 10.1080/00107519508222149

[9] Charles H. Bennett, François Bessette, Gilles Brassard, Louis Salvail, John Smolin, Experimental quantum cryptography, Journal of Cryptology, 1992, Volume 5, Number 1, Page 3.

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

D-Wave Systems: www.dwavesys.com

Alpine Quantum Technologies: www.aqt.eu

Entanglement Partners: www.entanglementpartners.com

Elyah: www.elyah.io

Knowledge and skills needed for developing the Entrepreneurial Case

- Communication protocols (P);
- Cryptography (P);
- Information theory (P);
- Analytical way of thinking (P);
- Cryptographic protocols (D);
- Quantum cryptography (D);
- Quantum computing (D);
- Programming abilities (D).

Figures describing this Entrepreneurial Case

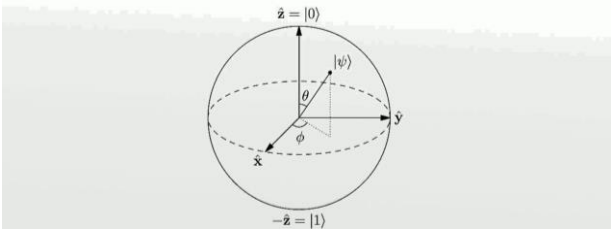

Figure 1. Quantum Turing Machine

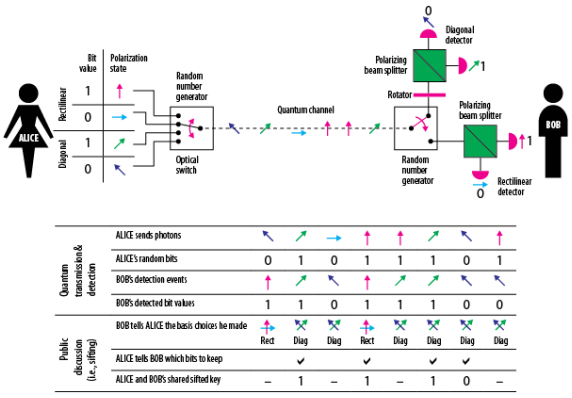

Figure 2. Quantum computing principles

3D printed Objects: from Simple Gadgets to Implants

Case study URL: https://urlzs.com/Tb42y

Authors: Ildiko Papp, Marianna Zichar

Keywords: 3D Printing; 3D modeling; 3D reconstruction; customization; innovative solutions

H2020 challenge addressed by the Entrepreneurial Case: Europe in a changing world - inclusive, innovative and reflective societies

Description of Entrepreneurial Case:

Every human is unique and that is why the solution for many problems related to people also needs a unique approach. This is valid in healthcare and in different fields of wellbeing as well. 3D modeling and 3D printing are exactly technologies that are suitable to deal with problems of customization [1]. The range of modeling software products, operating principles of 3D printers, characteristics of raw materials, and complexity of problems vary intensively, so our first task is to have a general overview on these topics [2].

Some typical applications that seem reasonable for a start-up company: Different small (PLA, or ABS) objects printed with a desktop FDM printer, such as fidget spinner, massage roller, customized medicine boxes; prototypes of braces (for broken bones, braces in dentistry, etc.) [4, 5].

With sufficient knowledge, and maybe in cooperation with other companies, the range of 3D modeled and printable objects can be much wider: 3D reconstruction, visualization of the human anatomy based on point clouds coming from CT images to practice medical interventions or to make the patients engaged into his treatment; 3D printed (metal or ceramic) implants

Company of any size can be committed in social responsibility by taking part in different movement such as e-NABLE (http://e-nable.org).

Questions that need answers during the Entrepreneurial Case development

Technical aspect

- Students will need to become familiar with the basic operating principles of 3D printers
- Overview and classification of raw materials
- How to turn a point cloud into a 3D model
- First steps in getting to know a free design software

Business aspect

- Student teams will need to identify potential customer segments for services they will develop [3, 6].
- Student teams will need to look for further 3D printable objects that can support humans' health and wellbeing.
- Students teams will identify what kind of interfaces they can use to reach the potential customers [8].
- Students teams will explore how the cost of their services can be determined and what kind of impact of additive manufacturing can have on business competitiveness [7].

Social aspect

- Student team will overview what skills an employee should have and whether people with some kinds of disabilities could be employed at the company or not.
- Student team will look for the impact of customized 3D printing on the environment.
- Student team will explore civil organizations, or movements (such as e-NABLE) which can connect the company with the society.

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] What is 3D printing, A definitive guide to additive manufacturing, Available: *https://www.3dhubs.com/what-is-3d-printing#a-brief-history-of-3d-printing*

[2] K. V. Wong, A. Hernandez, "A Review of Additive Manufacturing", *International Scholarly Research Network ISRN Mechanical Engineering*, Volume 2012, 10 pages, Available: *http://downloads.hindawi.com/journals/isrn.mechanical.engineering/2012/208760.pdf*

[3] How will 3D printing make your company the strongest link in the value chain, Available: https://www.ey.com/Publication/vwLUAssets/EY-3d-druck-studie-executive-summary/$FILE/ey-how-will-3d-printing-make-your-company-the-strongest-link-in-the-value-chain.pdf

[4] S. Radhakrishnan, "3D printed implant fuses bone repair broken limbs", 2017. Available: https://www.ibtimes.com/3d-printed-implant-fuses-bone-repair-broken-limbs-2631370

[5] The World's First Dynamic Printed Insoles, Available: https://www.materialise.com/en/cases/worlds-first-dynamic-printed-insoles

[6] P. Holzmann, R. J. Breitenecker, A. A. Soomro, E. J. Schwarz, "User entrepreneur business models in 3D printing", *Journal of Manufacturing Technology Management*, Vol. 28 Issue: 1, pp. 75-94, 2017. Available: http://www.emeraldinsight.com/doi/pdfplus/10.1108/JMTM-12-2015-0115

[7] M. K. Niaki, F. Nonino, "*Impact o*f additive manufacturing on business competitiveness: a multiple case study", *Journal of Manufacturing Technology Management*, Vol. 28 Issue: 1, pp. 56-74, 2017. Available: https://doi.org/10.1108/JMTM-01-2016-0001

[8] O. Reichardt, "3D Printing and its Impacts on Society", 2014. Available: https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2014/01/3d-printing-and-its-impact-on-society#

[9] A. Pirjan, D. M. Petrosanu, "The Impact of 3D Printing Technology on the Society and Economy", *Journal of Information Systems & Operations Management*, Vol. 7 Issue: 2, pp. 360-370, 2013. Available: ftp://ftp.repec.org/opt/ReDIF/RePEc/rau/jisomg/Wi13/JISOM-WI13-A19.pdf

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

3D Printing Studios: https://www.3dprintingstudios.com
Materialise: https://www.materialise.com/en/industries/healthcare
3D Systems: https://www.3dsystems.com

Knowledge and skills needed for developing the Entrepreneurial Case

- basic ICT knowledge (P);
- to have interest in 3D printing (P);
- social empathy (P);
- experience in 3D technologies (D);
- to be curious and prolific Internet researcher (D)

Figures describing this Entrepreneurial Case

Figure 1. 3D printed brace

Figure 2. 3D printed prosthetic hand printed in the frame of e-NABLE movement

Automotive Software Development and the Future of Electromobility

Case study URL: https://urlzs.com/Hekhe

Authors: Hrvoje Vdovic, Dario Pevec

Keywords: automotive software; electric vehicles; connected vehicles; autonomous vehicles; V2V; V2I

H2020 challenge addressed by the Entrepreneurial Case: Smart, green and integrated transport

Description of Entrepreneurial Case:

Not a single industry operating today exists, that is not at least partially governed by software, and automotive industry is no different. In 2008, a conservative assessment of the average software value per car was $425 and it is estimated to increase to $575 by 2020 [1], indicating a rise in value of over 35%. Furthermore, the worldwide market value of automotive embedded software is estimated to grow from $30 billion in 2008 to over $52 billion in 2020 [1].

Software is an indispensable part of today's vehicles and its importance is perhaps the most significant in electric vehicles (EVs). EVs are actively pushing for a bigger share in the automotive market and are poised to replace internal combustion engine vehicles in the coming years as they emerged as a sustainable, green solution to reduce the CO2 emissions.

Software can increase an EV's energy and cost efficiency, safety and comfort, all of which are significant aspects customers consider when purchasing a new vehicle. In addition to EVs, connected and autonomous vehicles are fast becoming a reality and with them the importance of software in vehicles increases tenfold.

The entrepreneurial case can be realized by identifying the possible automotive software improvements regarding above mentioned aspects important to EV customers (energy and cost efficiency, safety and comfort) and proposing a solution which addresses these challenges.

Questions that need answers during the Entrepreneurial Case development

Technical aspect

Student teams will need to identify and provide more details about the current state of technology and software used in EVs [2], [3]. Students are expected to get familiar with the following:

- In-vehicle networks, their capabilities and security (CAN, LIN, FlexRay, MOST, Ethernet) [4]
- Vehicle infotainment and operating systems (Windows Embedded Automotive, Android Auto, Apple CarPlay)
- Vehicle-to-vehicle (V2V) and Vehicle-to-infrastructure (V2I) technology [5], [6]
- Vehicle perception (camera, radar and ultrasonic systems)
- Autopilot features of modern EVs [7]

Students will need to use the acquired knowledge of different technologies to address the chosen automotive software challenge.

Business aspect

Student teams will need to identify an aspect important to potential EV customer such as energy and cost efficiency, safety and comfort and offer a product or a service which solves a problem from that domain. Students will need to specify:

- Who are the product's targeted customers?
- What is the added value of the product?
- What are the costs of development of the product?
- How will the product be distributed?
- What revenue streams are you expecting to finance your product development?

Social aspect

Student teams will need to identify the impact of the solution on the following stakeholders:

- Infrastructure owners
- Vehicle owners
- Vehicle users

Students will also need to explore the impact of the solution on the society as a whole, answering questions such as:

- Will the proposed solution reduce the number of accidents on the road?
- Will the proposed solution impact the labour market in any kind, causing people to lose jobs?
- Will the proposed solution reduce pollution?
- Will the proposed solution reduce traffic congestions?

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] Juliussen, Egil, and Richard Robinson. "Is Europe in the driver's seat? The competitiveness of the European automotive embedded systems industry." Institute for Prospective Technological Studies, European Comission, Londres (2010).

[2] Lukasiewycz, Martin, et al. "System architecture and software design for electric vehicles." Design Automation Conference (DAC), 2013 50th ACM/EDAC/IEEE. IEEE, 2013.

[3] Buckl, Christian, et al. "The software car: Building ICT architectures for future electric vehicles." Electric Vehicle Conference (IEVC), 2012 IEEE International. IEEE, 2012.

[4] Wolf, Marko, André Weimerskirch, and Christof Paar. "Security in automotive bus systems." Workshop on Embedded Security in Cars. 2004.

[5] Coppola, Riccardo, and Maurizio Morisio. "Connected car: technologies, issues, future trends." ACM Computing Surveys (CSUR) 49.3 (2016): 46.

[6] Gerla, Mario, et al. "Internet of vehicles: From intelligent grid to autonomous cars and vehicular clouds." 2014 IEEE world forum on internet of things (WF-IoT). IEEE, 2014.

[7] Jo, Kichun, et al. "Development of autonomous car—Part II: A case study on the implementation of an autonomous driving system based on distributed architecture." IEEE Transactions on Industrial Electronics 62.8 (2015): 5119-5132.

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Tesla: https://www.tesla.com

Rimac Automobili: http://www.rimac-automobili.com/en

Knowledge and skills needed for developing the Entrepreneurial Case

- Ability to work in a team (P),
- Knowledge about TCP/IP protocol stack (P),
- Basic programming skills (P),
- Presentation skills (P),
- Software design (D),
- Hardware design (D),
- Knowledge about automotive industry (D), and
- Entrepreneurial skills (D)

Figures describing this Entrepreneurial Case

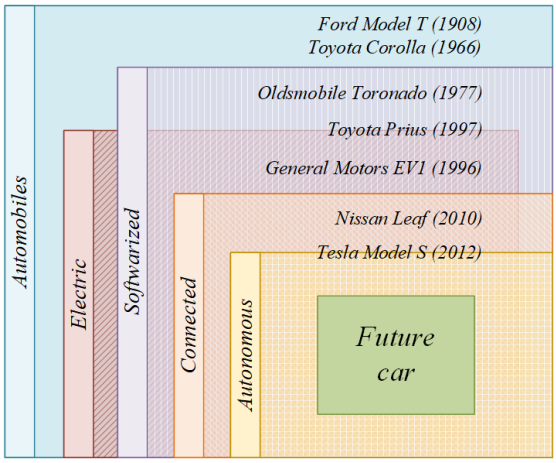

Figure 1. Automotive evolution viewed through four properties: electric, softwarized, connected, autonomous

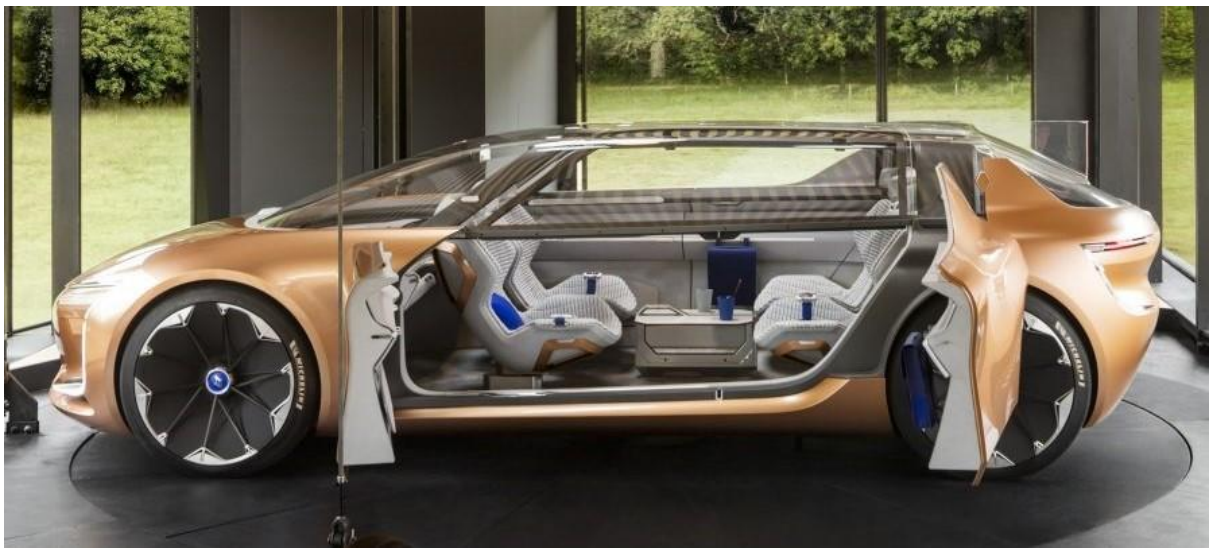

Figure 2. Renault Symbioz – autonomous, connected and electric vehicle concept

Price Automation in Smart Grocery Stores

Case study URL: https://urlzs.com/G34Mn

Authors: Birgit Graf, Franziska Plate, Niklas Kirfel, Dominik Schneider

Keywords: price automation; smart city; IoT; digitalization; smart grocery store

H2020 challenge addressed by the Entrepreneurial Case: Europe in a changing world - inclusive, innovative and reflective societies

Description of Entrepreneurial Case:

You are an entrepreneur and you believe in the idea of price automation within grocery stores. By introducing your solution, grocery stores can adapt their prices all-automatically via a network connection (e.g., NB-IoT, campus network or 5G). Utilizing connected electronic shelf labels and a pricing automation Artificial Intelligence (AI), the solution enables retailers to change their prices based on competition, special events and promotions, etc. Retailers can save time by implementing your solution and can reduce staff expenses. Customers will experience more appealing prices instantly and in real-time. In addition, prices can be adjusted automatically to date and time in order to offer discounts on goods with an expiry date such as vegetables or meat to avoid wasting the goods. Furthermore, the idea of a price automation can be adopted with other technologies like Virtual Reality to make the shopping experience more attractive.

In this case study students can elaborate:

- an assessment/evaluation of suitable technologies
- direct and indirect business models
- the end-to-end value chain and essential stakeholders/partners
- a detailed business case
- a market analysis
- a distribution concept
- societal topics regarding price automation
- other technical, business and societal topics.

Questions that need answers during the Entrepreneurial Case development

Technical aspect

- Which technology do you see as the most relevant/fitting solution for the price automation use case? (NB-IoT, GPS, Bluetooth, UMTS, LTE, Wi-Fi, …)
- Based on which criteria do you select the fitting technology? (strengths, weaknesses, opportunities, threats, costs)
- Which external factors influence the implementation of the technology? (country, politics, regulation, …)
- Which data security and privacy issues should be considered?

Business aspect

- In which aspects does a price automation solution support a retailer?
  - Costumer experience, rate of wasting goods, unique selling proposition, …
- Which costs and which financial and qualitative benefits arise from the use of a price automation solution? Which benefits can be achieved on behalf of the customer?
- Should a retailer consider an “as a service” approach or buy and run a solution by himself?
  - Will you provide the whole solution or only some components for the solution?
- Which are the most relevant partners/stakeholders to realize the use case and what are their requests towards your enterprise? How does the end to end value chain look like?
- Create a Business Model Canvas for the price automation business model.

Social aspect

- How do the work conditions change for a retailer and his employees? Which are the positive and which are the negative changes?
- Does a price automation solution create or cost jobs? How do job profiles change within the retail sector?
- Is there a necessity for politics to either foster or decelerate a price automation solution? How should political measures look like?

- What could be the impact on the business case if customers feel uncomfortable with digital changing electronic shelf labels? Is there an impact on consumer behaviour? (acceptance of solution?)
- How can customer protection law pose a threat to your business case?

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] https://www.abiresearch.com/press/electronic-shelf-labels-revenues-to-reach-us2-bill/
[2] https://www.google.com/patents/US7152040
[3]https://www.google.de/patents/US20150178767?hl=de&dq=business+case+Electronic+shelf+labels
[4] Evans, J. G., Shober, R. A., Wilkus, S. A., & Wright, G. A. (1996). A low-cost radio for an electronic price label system. *Bell Labs Technical Journal*, *1*(2), 203-215.
[5] Kalyanam, K., Lal, R., & Wolfram, G. (2010). Future store technologies and their impact on grocery retailing. In *Retailing in the 21st Century* (pp. 141-158). Springer, Berlin, Heidelberg. Link:https://www.researchgate.net/profile/Kalyan_Raman5/publication/226259690_Integrated_Marketing_Communications_in_Retailing/links/563bb5a608ae34e98c47cfee/Integrated-Marketing-Communications-in-Retailing.pdf#page=99
[6] https://www.forbes.com/sites/lanabandoim/2018/12/23/how-smart-shelf-technology-will-change-your-supermarket/#4b0c6e64114c
[7] Kämäräinen, V., Småros, J., Holmström, J., & Jaakola, T. (2001). Cost-effectiveness in the e-grocery business. *International Journal of Retail & Distribution Management*, *29*(1), 41-48. Link: https://www.researchgate.net/profile/Jan_Holmstroem/publication/235294205_Cost-effectiveness_in_the_e-grocery_business/links/5746c95608ae9f741b43b23d.pdf
[8]https://www.m2comm.co/m2comm-accelerates-retail-4-0-proposing-innovative-electronic-shelf-label-fresher-packs/
[9]https://www.businesswire.com/news/home/20161212005436/en/Top-5-Vendors-Global-Electronic-Shelf-Labels

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Altierre: http://www.altierre.com

Displaydata: https://www.displaydata.com/de#banner-section

Pricer: https://www.pricer.com

Knowledge and skills needed for developing the Entrepreneurial Case

Knowledge about

- State-of-the-art technologies, e.g. network trends like “5G” as well as IT trends like “(Narrowband) Internet of Things”, “Blockchain” (P)
- Connectivity technologies (P)

- Connected use cases (high level architecture, hardware, high level protocols) (D)
- Automation and optimization possibilities enabled by Business Intelligence and Data Analytics (keyword: Big Data) (D)
- Industry insights and market needs of “grocery stores” (P)
- Digitalization and connected things know-how (D)
- Entrepreneurship and foundation of start-ups (P)
- Marketing and distribution concepts (D)
- People, resource and change management (D)
- Legal boundaries and regulations (e.g. forbidden price agreements between companies, …) (D)

Skills

- Research and analytical skills (P)
- Economic skills for the identification of value streams, creation of business models and development of business cases (D)
- Conceptual thinking and ability to transfer business requirements into technical implementation details (P)
- Commitment, determination and ability to work in a team (P)
- Independent and conscientious work in distributed teams (P)
- Creativity and innovative thinking (D)
- Visualization and presentation skills (P)

Figures describing this Entrepreneurial Case

Figure 1. Intelligent camera system for shop tracking and security

Figure 2. Smart card for grocery stores

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Hochschule fur Telekommunikation Leipzig


Szechenyi Istvan University


University of Telecommunications and Post


University of Zilina


Institut Mines Telecom – Telecom Bretagne


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