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PROMOTING INTERDISCIPLINARY THINKING WITH "SCIENCE SHOPS" IN INDUSTRY 4.0

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Vilnius
2022

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CONTENT

I. ANALYSIS OF CURRENT PRACTICE OF SCIENCE SHOPS

Identification of existing organisational models of Science Shops

The Sustainable Development Goals (SDGs) set by the United Nations General Assembly have a better chance to be addressed if all societal actors are engaged in the development of solutions. According to the European Commission ,public engagement (PE) in Responsible Research and Innovation (RRI) is about co-creating the future with citizens and civil society organisations, and also bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology. Therefore it is evident, that interaction between local communities, associations, NGOs, which represent a wide range of interests and ties, and Higher Education Institutions (HEIs) which create and transfer knowledge, is crucial.

The current societal challenges and their growing complexity, make us realize that the expertise of civil society organisations (CSOs) becomes more and more important. CSOs can play a crucial role in increasing the inclusiveness and effectiveness of proposed solutions to societal challenges and can help to improve governance and regulation. Research provides a solid basis to build solutions on, however, the lack of resources and access to research expertise often hinders local communities and other societal actors to be involved. Universities can have an active role in helping societal stakeholders to surpass these obstacles, by taking an active role in relevant research and addressing societal issues.

For a few decades, the Science Shop model (Living Knowledge, 2016) of community-based research (CBR) has been successful in bringing students, researchers, and civil society together towards tackling real issues at local and regional levels. This approach not only had a positive impact on the co-creation of solutions to societal issues but also helped to build stronger links between society and universities, to keep students' research agenda up to date.

According to the Living Knowledge Network, a Science Shop could be defined as a unit or an intermediary, that provides independent, participatory research support in response to concerns experienced by civil society. The term 'science' is used here in its broadest sense, embracing all branches, such as social, natural, formal, and applied sciences.

Just as there are no identical companies, there are no identical Science Shop projects either. The organisational design of the Science Shop depends, in all cases, on the goals of the organisation in setting up Science Shops, the way in which the organisation operates and the resources available, and the established traditions of cooperation with the non-governmental organisations (NGOs), civil society organisations (CSOs) sector.

Science Shops that are carried out in different European countries fall into the following main organisational models:

1. A Science Shop as one of the subdivisions/structural units of a higher educational institution or a research institute.
2. Public enterprise – intermediary, independent from the higher education institution.
3. E-Science Shop – Activities of Science Shops are carried out with only the co-ordinator of activities and assigning functions to other divisions but without establishing a separate unit.

1. A Science Shop as one of the subdivisions of a higher educational institution:

As Science Shop projects are carried out by student teams led by professional researchers, it is clear that these projects are particularly closely linked to higher education institutions and their organisational processes. Therefore, the Science Shop as a branch of a higher education institution is one of the most common organisational models. It is easier for such Science Shops, especially if their activities are in line with the strategic priorities of a higher education institution, to ensure continuity of activities since such an organisational unit is not solely dependent on project funding. At the same time, such Science Shops (i.e. a subdivision of a higher education institution) have a closer connection with the other subdivisions carrying out studies than an independent public body and, accordingly, better access to the students who carry out the research.

2. The advantage of a Science Shop as an independent public institution is that it has more freedom in making decisions regarding the organisation of its processes, it is not dependent on the student timetable, and in many cases it has an elaborate network of external partners. However, an independent Science Shop is destined to face an everlasting issue of continuity, as it is highly dependent on the project funding.

3. E-Science Shops is yet another model of activity, that is conducted without a physical environment. Such a model is common in the case of a small Science Shop, where a coordinator only works part-time. In this case, the coordinator (and/or other members) communicates with the clients and project promoters remotely, and meeting rooms are reserved only when needed. Such a model is very suitable for testing the activities of a Science Shop, as it requires fewer resources (no need to allocate separate premises, there is no necessity to hire new staff for coordination).

In spite of the variety of organisational models of the Science Shop, all of them are characterised by the following stages of activity:

1. Identification of the public interest (while communicating directly with the clients, or through sites/registration channels/tools created for registration or Science Shops, external stakeholders can register problems)
2. Selection of the identified problems based on specific criteria, e.g.:
   - Requirement directly reflects the public/community interest
   - Problems are presented by non-profit organisations or individuals, businesses, communities, etc. interested in a non-commercial solution to the problem.

- The results of the study must be made public and contribute to solving public problems
- Clients do not have the possibility to finance the research themselves

3. Transformation of a problem into a scientific question that could be addressed by research
4. Conducting the research
5. The results of the study are presented in two ways: in the Science Shop report and in the report to the client on the possible solution to the current problem.

Analysis of Science Shops in terms of competence requirements in Industry 4.0

The beginning of the era of the industrial revolutions (Fig. 1) brought about important transformation in humanity, and understanding of the world, attitudes, as well as individual people's abilities and the requirements, started to change alongside. Such a shift was caused not only by new technological inventions, but also by visions of the world of the future and humanity. Mankind has changed in various ways to adapt to the changes introduced by industrial revolutions, and eventually, people began initiating industrial and human change, not only by advances in technology but also by educating people (employees) about and preparing them for future revolutions, as well as encouraging people to initiate change themselves.

The globe is currently facing a transition from Industry 4.0 to Industry 5.0, and while principles and trends of Industry 4.0 are being implemented (covering advanced mass production, the Internet of Things, robotics and artificial intelligence, big data, cloud computing, etc.), humanity is also moving to new trends and directions shaped by revolution Industry 5.0 (human-robot cooperation, bio-economy, smart society and sustainability, renewable sources). The fundamental difference is that Industry 4.0 has been less focused on primary principles such as social justice and sustainability, but more attention is paid to digitisation and artificial intelligence-driven technologies to improve efficiency and flexibility.

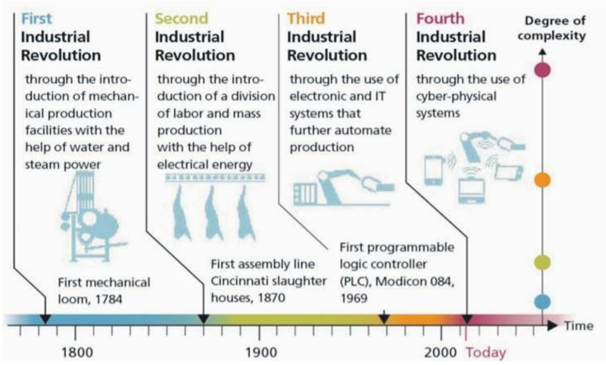


Fig. 1. Industrial revolutions timeline (DFKI, 2011)

As governments like Germany overhaul their economic strategies in the face of unprecedented challenges, including an exponentially faster rate of technological change, meaningful and relevant changes in education are urgently needed to achieve more inclusive and sustainable development for all, not just for the privileged few. Ethical questions about how to harness the knowledge and skills we possess to create new products and opportunities loom large. To shorten the period of "social pain" and maximise the period of "prosperity" for all, education systems need to undergo transformative change too (OECD, 2021).

For quite a while, the debate on social innovation has highlighted the role of exponentially accelerating technologies, technologies that double their potential at regular intervals while at the same time becoming cheaper. Exponential technologies enable small groups of people to solve major problems. A few dozen decades ago, the emergence of major changes in public life was influenced only by large corporations or governments of large countries, however, due to exponential technology, the situation has changed a lot. Today, social innovation can be introduced by start-ups and small businesses and can be influenced by society as a whole. Airbnb, for example, has created the world's largest hotel chain with no real estate. Apps Uber, Lyft, Bolt have taken over almost the entire taxi market in all major cities, but the companies that run them do not have any of their cars.

Technologies, which are currently evolving at such a rapid pace, include some of the most powerful innovations that have previously only been talked about in science fiction: quantum computers, artificial intelligence, robotics, augmented reality and virtual reality, nanotechnology, biotechnology, innovative materials, sensor applications, 3D printing, blockchains, etc.

And yet, according to P. Diamond and S. Kotler (2020), this progress, despite all its radicalisation, is already yesterday‘s news. Technology convergence is currently the most pressing – when waves of self-exponentially developing technologies start to merge with others. Such merging – convergence – is shaping technological innovation on an unprecedented scale, which is already difficult to predict and control. At the moment, there is no question of differences between generations anymore, because the technological revolution can now take place in a few months. However, the human brain has not been designed at such a pace for progress; after all, it is not easy to track the exponential progress of one technology, let alone convergence innovations. According to the mathematical calculations of futurologist R. Kurzweil (2001), over the next century, we will experience technological progress of the same magnitude that has taken humanity 20 thousand years in the past.

Converging technologies lead to major changes that do not only create opportunities. According to Bostrom (2001), which deals with the global risks of catastrophes, exponential technologies tend to turn into a threat to the existence of humanity. For example, the unrestricted development of nanotechnology is the scenario put forward by E. Drekler, according to whom the development of molecular nanotechnologies could lead to a global catastrophe when uncontrolled self-replicating machines consume all biomass on Earth; or out-of-control artificial intelligence pursuing its own goals, cyber-terrorism targeting energy systems, biohacking with the help of biological weapons, genetically modified organisms depleting ecosystems, etc.

In light of all of the above, the ideas of S. Brando, founder of the Long Now Foundation, about developing thinking from a long-term perspective in order to empower humanity to overcome the emerging global threats, seem to be rather rational.

According to the World Economic Forum (2019), the five most critical environmental threats facing humanity of the time are the drinking water crisis, the inability to mitigate and adapt to climate change, the loss of biodiversity and the collapse of ecosystems, extreme weather conditions and natural disasters, and man-made natural disasters. All of these threats are interrelated. Of course, technology can help humanity deal with the negative environmental consequences it has caused itself, but this is only possible in the case of unprecedented collective efforts. Although all emerging technological innovations can already help solve problems, cooperation remains the missing link.

Apart from applying a long-term perspective, it is important to find a distinctive way to take advantage of the current context. A good example, reflecting both long-term orientation and a unique path in the context of global challenges, could be the Netherlands. Most of the country is below sea level, and this region of Europe is under a serious threat from climate change. However, instead of seeing rising floods as a problem requiring immediate action and the construction of more powerful dams, which would obviously require permanent repairs and maintenance in the near future and, in the long term, the construction of new dams, the Dutch were the first to choose a distinctive unique solution. The key solution was to allow water to enter wherever it can get, instead of trying to defeat nature. The Dutch are setting up lakes, expanding channels, parks, and courts that increase the quality of day-to-day life; at the same time, it expands already enormous reservoirs into which water will flood as seas and rivers spill (Kimmelman, 2017).

According to P. Diamandi (2020), who runs the US University of Singularity, two components of continuous learning are particularly important to understanding the reality of converging exponential technologies: psychological and physical. The physical component is involved in analysing the technologies themselves and their capabilities, while the ability to think quickly and holistically becomes very important from a psychological point of view.

Never endless synthesis of new technologies with the human race, and in exceptional cases, their opposition, generates an easy, but at the same time, complicated adaptation conditions (Fig. 2.), e.g., when technological progress outstrips knowledge among the majority of humanity, or vice versa. This results in stagnation of technological change and of human adaptation, as well as withdrawal from any progress. It is often the case, when either component, ‚technology' or ‚competence', has to catch up with both the change that has already taken place and the new industrial changes that lie ahead. As presented in the OECD (2021) research report, technological innovation and technological education are involved in a continuous race against each other, that are preconditioned not only by time, but also by such factors as the social aspect, and state policies, and human readiness to accept the innovations.

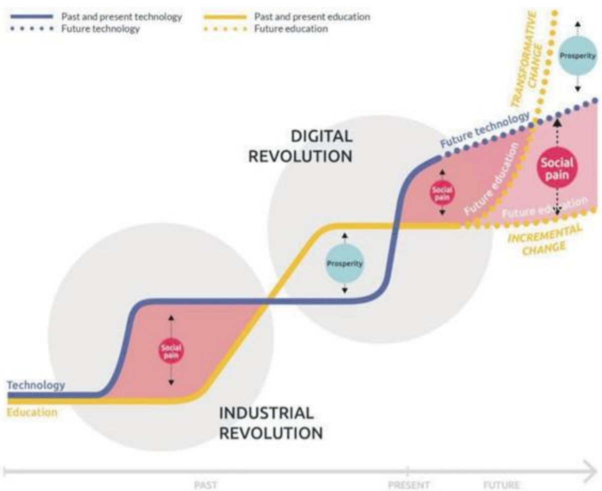


Fig. 2 Competition between technologies and education evolution (OECD, 2021)

In addition, apart from these ever-changing and racing systems, other areas, such as green energy, etc., are faced with revolutions and changes which, on the one hand, are part of industrial revolutions, and on the other, require other technological changes and specialist competencies. This constant confrontation among systems and subsystems helps and at the same time hinders the formation of clear global goals both in the field of technology and in the need for future professional competencies (Leong et al., 2020).

Therefore, it is especially important to have strategies for each company, institution, and state, as well as an overall strategy that would not hinder the ongoing change (industrial revolution), but would help to grow faster and better. One way to do this is to have clear strategies in each area that are jointly integrated into the strategy of the industrial revolution(s) (Santos et al., 2017).

For education to keep abreast with technological and other social and economic changes, we must first recognise what computers are good at and what they are not good at. Computers, including Artificial Intelligence, are not as good as humans at abstract tasks, manual tasks, tasks requiring complex contextual information, and tasks requiring ethical judgments (Luckin and Issroff, 2018; Autor and Price, 2013).

However, with the advent of universal, compulsory public schooling, access to education improved. Thus, more people could both contribute to and benefit from the industrial revolution; a time of “prosperity” followed a time of “social pain” (Goldin and Katz, 2010).

This confrontation represents uneven growth that hinders progress. Thus, the aim of this confrontation is to achieve a balanced growth of technology and humanity, the focal point of which is a sustainable society. Therefore, growing technologies and their level must hold as much importance as the preparation and adaptation of people and the steady growth of required knowledge and skills with technological change. The earlier we see the qualities and competencies needed for the world of the future, the smoother and faster the change will take place, not only for industrial revolutions but also for the development of a sustainable society. It is, therefore, crucial to take lessons from the industrial revolutions in the past and to anticipate and prepare for those in the future as early as possible.

To solve this problem, every country initiates industrial revolutions, which have both their own characteristics that reflect national specifics, and features that unite global change (Fig. 3).

Fig. 3. List of initiatives for the digitisation of industry per EU (European Union, 2017)

Many countries have made long-term strategies and investments under one coherent approach or through several more specific initiatives. One of the most thorough approaches to digitisation is Industrie 4.0 in Germany. The country‘s specific strengths include a coherent strategy built by several ministries and an „Industrie 4.0“ platform now led by industry. It has taken a broad view that includes manufacturing, services, business models, strategies working conditions, and security aspects. The German cluster policy has led to strong ecosystems with a local smart specialisation. In addition, international cooperation between the companies and research organisations gives an extra boost to the digitisation of industries (European Commission, 2017)

Another example of an approach that cuts throughout the society is SWEDEN which has also reached leading positions in several digitisation comparisons and reviews. National measures are geared to the needs of the local companies and match well in line with the DEI priorities. The national platform strategy is bound to industry organisations and based on existing cooperation structures in technology transfer (e.g. 5 „innovation partnership programs“) (European Commission, 2017).

Research has shown that each country or region must take into account and consider its specificities and maximize its geographic and specific potential of knowledge and experience when formulating guidelines for the industrial revolution (Lepore and Spigarelli, 2020). Then constant cooperation with other countries will allow you to feel the greatest impact of the industrial revolution (s).

More detailed information on the specifics of each country and industrial revolutions is provided in Annex 1. The results of the study (European Commission, 2017) (Fig. 4.) show that the impact of all the factors (Fig. 4.) influencing the scale, time, and quality of the industrial revolution vary from country to country. The wide variation in values is due to the different interpretations of the analyzed data in each country and reflects differences in the structures of public organisations and data analysis systems (Castelo-Branco, Cruz-Jesus, Oliveira, 2019). Therefore, the total weight (index) used is a complex quantity, all components of which should be proportionately large. Only then will each country be ready to smoothly transition and coexist in industrial change.

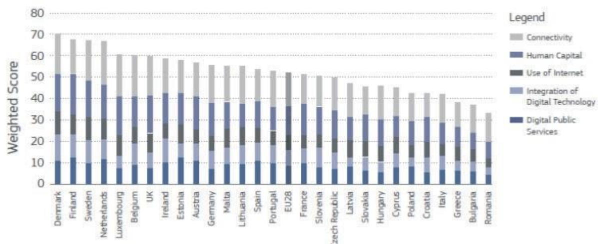


Fig. 4. Digital Economy and Society Index, by Main Dimensions of the DESI (European Comission, 2017)

If industrial revolutions are analyzed as a complex quantity, they should still be divided into small groups and evaluated separately, because industrial revolutions are not just one relative measure of achievement or not. It is an ongoing evolutionary process in which we find the smaller components that determine the significance of the evolutionary process of industrial revolutions and the impact of each of the domains on the final outcome (Fig. 5).

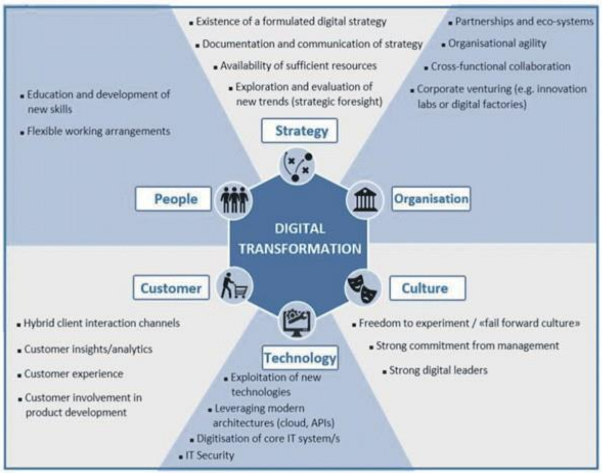


Fig. 5. Digital Transformation Framework with Sub-Dimensions (Bumann and Peter, 2019)

There are many research studies and conferences that have addressed Industry 4.0. In addition, some scholars and futurists already started the discussion on Industry 5.0 (Kadir Alpaslan and Cicibaş, 2017, Kadir Alpaslan and Cicibaş, 2018). They put forward various visions for Industry 5.0. One emerging theme for Industry 5.0 (Fig. 6.) is human-robot co-working (Kadir Alpaslan and Cicibaş, 2018). At this point, we cannot be sure what the theme of Industry 5.0 (Table 1) will be. But we can be sure that human-robot coworking will be a significant innovation for society and it will significantly affect the way we conduct businesses. (Demir, Döven, Sezen, 2019)

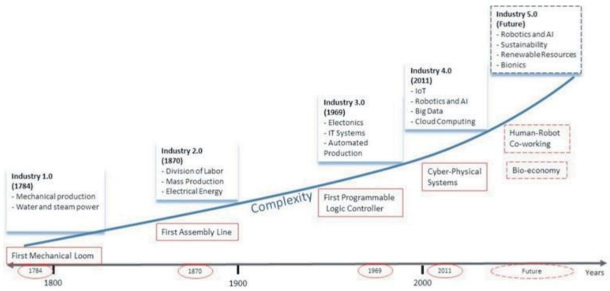


Fig. 6. From Industry 1.0 to Industry 5.0 (Demir, Döven, Sezen, 2019)

EPBO Švietimo ir gebėjimų direktorato direktorius Andreas Schleicher 2019 metais pripažino, jog „Švietimas nebėra vien tik mokinių mokymas; svarbiau mokyti juos sukurti patikimą kompasą ir navigacijos įrankius, kad jie rastų savo kelią pasaulyje, kuris tampa vis sudėtingesnis, nepastovesnis ir neapibrėžtesnis. Mūsų vaizduotė, sąmoningumas, žinios, įgūdžiai ir, svarbiausia, mūsų bendros vertybės, intelektualinė ir moralinė branda bei atsakomybės jausmas yra tai, kas leis pasauliui tapti geresne vieta“ (Schleicher, A. 2019).

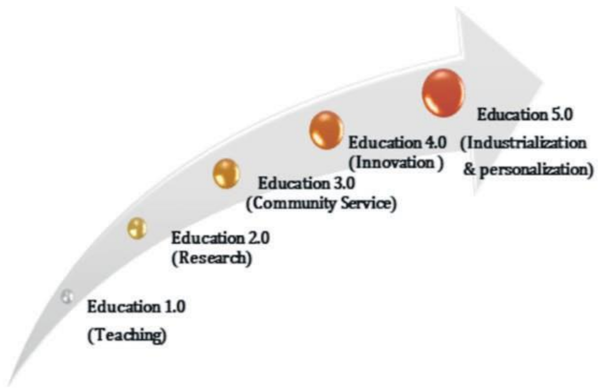
As Andreas Schleicher 2019, Director of the OECD Directorate for Education and Skills, commented in 2019, “Education is no longer just about teaching students something alone; it is more important to be teaching them to develop a reliable compass and the naviga-

Table 1. A Comparison of Industry 4.0 and Industry 5.0 Visions (Demir, Döven, Sezen, 2019)

	Industry 4.0	Industry 5.0 (Vision 1)	Industry 5.0 (Vision 2)
Motto	Smart Manufacturing	Human-Robot Co-working	Bioeconomy
Motivation	Mass Production	Smart Society	Sustainability
Power Source	Electrical power Fossil-based fuels Renewable power sources	Electrical power Renewable power sources	Electrical power Renewable power sources
Involved Technologies	Internet of Things (IoT) Cloud Computing Big Data Robotics and Artificial Intelligence (AI)	Human-Robot Collaboration Renewable Resources	Sustainable Agricultural Production Bionics Renewable Resources
Involved Research Areas	Organisational Research Process Improvement and Innovation Business Administration	Smart Environments Organisational Research Process Improvement and Innovation Business Administration	Agriculture Biology Waste Prevention Process Improvement and Innovation Business Administration Economy

tion tools to find their own way in a world that is increasingly complex, volatile and uncertain. Our imagination, awareness, knowledge, skills and, most importantly, our common values, intellectual and moral maturity, and sense of responsibility is what will guide us for the world to become a better place".

When it comes to industrial revolutions, we need to understand and prepare for the fact that, along with the 14 major areas of the industrial revolution (Takakuwa, Veza, Celar, 2018), the levels of preparation and adaptation for them are changing, including the science/study revolutions. (Fig. 7). Parallel and systematic growth allows the formation of key skills, attributes, and competencies to be acquired through study.



7 pav. Švietimo sistemos evoliucija (Saxena, Pant, Saxena, Patel, 2020)

No matter how we formulate the basic guidelines for preparing for Industrial revolution 4.0, which is already in place, and for those which await in the future, e.g. 5.0, we must keep in mind that the main goals and ways in which we aim to prepare must be agile and evolving to be able to keep up with the trends of 5.0 industrial revolution. The report of the OECD research project 2021, chapter „Future of Education and Skills 2030", emphasizes that educational revolutions consist of phases:

1. "Learning for 2030" to "Teaching for 2030". It explores the types of teacher competencies and teacher profiles that can help all students realize their potential. Lecturers are key to implementing curricula effectively. While technology may become a superior vehicle for transmitting knowledge, the relational aspects of teaching – being a good coach, a good mentor – will remain human capacities of enduring value (Schleicher, 2018). Identifying the competencies held by the most effective and successful lecturers can help countries enhance the quality of their teaching workforce.
2. "Curriculum redesign" to "curriculum implementation", where the main focus is on a curriculum change as a part of a larger system of change management; aligning curriculum changes with changes in pedagogies and evaluations; aligning curriculum changes with changes in initial teacher education and professional development (including school leaders).

An educational revolution requires not only the basic knowledge and competencies needed to ensure technological advancement but must be characterized by the development of ‚soft competencies' as well as of teamwork and leadership abilities. Curiosity and levels of professionalism must be nurtured in each and every field. The concretization of an educational compass to navigate, prepare for and adapt to industrial revolutions must include seven elements (OECD, 2021):

1. **Core foundations.** The OECD Learning Compass 2030 defines core foundations as the fundamen- tal conditions and core skills, kno- wledge, attitudes and values that are prerequisites for further learning across the entire curriculum. The core foundations provide a basis for developing student agency and transformative competencies. All students need this solid grounding in order to fulfill their potential to become responsible contributors to and healthy members of society.
2. **Transformative competencies.** To meet the challenges of the 21st century, students need to be empowered

and feel that they can help shape a world where well-being and sustainability – for themselves, for others, and for the planet – are achievable. The OECD Learning Compass 2030 identifies three "transformative competencies" that students need in order to contribute to and thrive in our world, and shape a better future: creating new value, reconciling tensions and dilemmas, and taking responsibility.

3. **Student agency/ co-agency.** Student agency is defined as the capacity to set a goal, reflect and act responsibly to affect change. It is about acting rather than being acted upon; shaping rather than being shaped; and making responsible decisions and choices rather than accepting those determined by others. In education systems that encourage student agency, learning involves not only instruction and evaluation but also co-construction. The concept of co-agency recognises that students, lecturers, parents, and communities work together to help students progress towards their shared goals.
4. **Knowledge for 2030.** As part of the OECD Learning Compass 2030, knowledge includes theoretical concepts and ideas in addition to practical understanding based on the experience of having performed certain tasks. The Education and Skills 2030 project recognises four different types of knowledge: disciplinary, interdisciplinary, epistemic, and procedural.
5. **Skills for 2030.** Skills are the ability and capacity to carry out processes and be able to use one's knowledge in a responsible way to achieve a goal. The OECD Learning Compass 2030 distinguishes three different types of skills: cognitive and meta-cognitive; social and emotional; and practical and physical.
6. **Attitudes and values for 2030.** Attitudes and values refer to the principles and beliefs that influence one's choices, judgments, behaviours, and actions on the path toward an individual, societal and environmental well-being. Strengthening and renewing trust in institutions and among communities require greater efforts to develop core shared values of citizenship in order to build more inclusive, fair, and sustainable economies and societies.
7. **Anticipation-Action-Reflection competency development cycle.** The Anticipation-Action-Reflection (AAR) cycle is an iterative learning process whereby learners continuously improve their thinking and act intentionally and responsibly. In the anticipation phase, learners become informed by considering how actions taken today might have consequences for the future. In the action phase, learners have the will and capacity to take action toward well-being. In the reflection phase, learners improve their thinking, which leads to better actions towards individual, societal, and environmental well-being. (OECD, 2021)

The table below presents a comparison of competencies developed during Science Shop projects and competencies required by Industry 4.0 under OECD Learning Compass 2030. The comparison clearly demonstrates that Science Shops, as a teaching method, significantly contribute to the development of those competencies that are required by Industry 4:

Table 2. A comparison of competencies developed during Science Shops and competencies required by Industry 4.0 under OECD Learning Compass 2030

Competencies required by Industry 4.0 under OECD Learning Compass 2030	Competencies developed during Science Shop projects
Fundamental competencies: • Basics of knowledge including language and mathematical literacy; • Basic knowledge about health, including physical and mental health and well-being; • Social and emotional foundations, including morality, ethics, digital literacy, and the ability to work with data.	**Cognitive:** • Ability to observe, evaluate and draw conclusions; • Search for answers and seeking to broaden horizons; • Adequate evaluation of oneself and of environment, etc. **Social:** • Tolerance and empathy, ethical thinking; • Social involvement and participation in public life; • Helping others; • Appropriate presentation of the work done, oratory skills; • Multifaceted and intercultural communication when working with the client and in a team; • Commitment.
Transformational competencies: • Construction of new value, • Solution to tension and dilemma, • Taking responsibility.	• Creative thinking when solving engineering problems and looking for alternative solutions; • Focused pursuit of goals; • Ability to adapt and meet challenges; • Conflict management; • Emotional stability; • Openness and transparency; • Taking responsibility.
Forecasting-acting-reflection cycle: • Awareness of a situation and its forecasting • Acting • Reflection	• Initiation and generation of new ideas; • Ability to act; • Ability to assess the impact of team solutions and actions.

Analysis of Science Shops in relation to other cooperation methods (hacklab, interdisciplinary projects)

A Science Shop project at Vilnius College of Technologies and Design started as one of the first study subjects to cover not only the application of specialized knowledge and skills but also the related fields of study (interdisciplinary thought), this way creating a complex education for students. Research issues encapsulate not only the specialty-related subjects of the students, but also the complexity of the adjacent, and especially different, fields. A Science Shop project is a subject that aims to acquaint students with the context of research and help them localize themselves in the research space; while performing practical and theoretical exercises students form a personal basis for research, develop a system of knowledge about research methodology, the planning, organisation, forms of presentation of results, submission of a research report and to form the ability to select and apply appropriate research methods. The project focuses on the organisation of non-profit Science Shops, citizens' initiatives, non-governmental organisations, and public administration in collaboration with the college students to realize the stages of research in the social, technological, and engineering fields.

While working on the Science Shop project, students develop existing competencies, as well as acquire new ones (e.g. the ability to plan, organize, carry out and evaluate practical activities in specific areas of professional activity, making an independent choice of technological, organisational, and methodological measures; the ability to learn independently in the field of their professional activities; ability to perceive moral responsibility for the impact of their activities and their results on social, economic, cultural development, well-being, and the environment; ability to consistently, argumentatively, in the correct language, present scientific research results, both in writing and orally, in accordance with established requirements, in accordance with academic ethics).

As the Science Shops started gaining popularity among students, and study programme committees and representatives of the business sector found them beneficial, the subject has expanded beyond the range of problems addressed. It created a need to initiate an interdisciplinary project which, by its very nature, is very close to the Science Shop project, but is more focused on the broad application of close scientific fields such as mechanics and electronics, and in some cases involving other scientific fields such as biology, etc. The subject is taught after the Science Shop project, so often students continue working on the same themes, exploring the problem in more detail, applying other methods and solutions, or they target new topics, which later become the focus of their Final Work. The interdisciplinary project is designed for students to develop competencies, to learn to apply specialist knowledge and knowledge of adjacent subjects, as well as to acquire the ability to apply them in an integrated way. The subject develops the skills needed to solve engineering problems, addressing which includes a wide range of knowledge, skills, and competencies in engineering (interdisciplinary thinking). Theoretical and practical knowledge shall be provided while solving a complex engineering problem, foreseeing a possible strategy for solving the problem, and its implementation. When addressing engineering challenges and problems in an integrated way, students develop individual and team skills, they learn to be critical of the selected problem-solving strategy, as well as acquire competencies to solve complex problems based on acquired knowledge and skills, studying related subjects of study.

Students studying the subject develop and gain the following competencies:

1. The ability to address the simple and medium complexity of cross-cutting areas of professional science and innovation;
2. Ability to apply the knowledge gained during studies to address interdisciplinary problems and to be critical of solutions and strategies.

One more, a completely different concept, is applied when conducting VTDK.hackLAB, an activity that unifies visions of the future specialists and of humanity. It is focused on voluntary post-lecture activities, although often becomes an integral part of studies. VTDK.hackLAB is a collaborative activity focused on modern DIY and Hacking practices. The highly interactive space covers both individual and project work, as well as creative workshops and lectures of various profiles. The work performed in the laboratory combines the synthesis of programming, technology, and art, which gives students the opportunity to create new objects, participate in creative projects, and conduct research. For example, a student A. Lipnickis participated in the exhibition Furniture-2014 organized by LITEXPO, where he presented his color sensor and a luminaire. VTDK.hackLAB is meant for programming and technology enthusiasts, artists, and anyone interested in the interaction between technology and the arts. The created informal environment provides an opportunity to focus on the created object and receive the necessary help in the areas of self-study and research.

Lecturers participate in the activities at the laboratory of innovative technologies VTDK.hackLAB, where they carry out consulting activities, and engage their students in the implementation of innovative projects and scientific and applied activities. Lecturers working at VTDK.hackLAB organize paid and free-of-charge creative workshops and lectures on various technical topics. Lectures are usually organized on the premises of VTDK.hackLAB, but there is also a possibility of external lectures. VTDK.hackLAB‘s activities range from idea to its implementation, during both consultation and implementation stages, and are open to the business and public arena. VTDK.hackLAB lecturers participate with students in projects and training related to the field of electrical engineering, which is carried out by the National Electrical Engineering Business Association, professional companies, and organisations.

VTDK.hackLAB laboratory became a space for creative workshop Meet – ROBOTAS, that was aimed at students interested in electronics and those who wanted to get acquainted with the basics of robotics, microcontrollers, and their programming, as well as the development of control algorithms.

The robot, created at the lab, followed the line using analog sensors with a gradient path and direction coordination system. It was presented at an event Robotiada, where the participants of the event, representatives of companies, and institutions were consulted.

At the VTDK.hackLAB, lecturer A.Pitrėnas together with students created 4 interactive projects (City Music, Digital Flame, etc.). The results of the projects were later presented during the Culture Night event in Vilnius.

A creative workshop Basics of Microcontroller Programming united 16 electronics enthusiasts to get acquainted with the structure of microcontroller, principles of operation, basics of programming, and the most important functions. An event The World in the Eyes of a Robot has received even more attention from the devotees to electronics and robotics.

As the diversity of the fields of activity demonstrates, VTDK.hackLAB is a multilayered space for a wide range of interests, covering aspects of idea generation and its implementation.

All the discussed topics, Science Shop Project, Interdisciplinary Project, and VTDK.hackLAB are relatively unique in their development, performance, but the goal is one and the same – to contribute to preparing students for a different market of the future and to educate people to become citizens of a sustainable society, that are able to work both as individual leaders, and members of a team, who might not know adjacent fields of science in-depth, but are able to solve complex problems and generate ideas how to address current and future issues.

II. TRANSFORMATION OF THE SCIENCE SHOP APPROACH TO INDUSTRY 4.0

Identifying the impact of Science Shop projects in relation to the needs of Industry 4.0

The industrial revolution "Industry 3.0" began in 1969, and the first Science Shop projects were launched in 1970 in the Netherlands to address "client" concerns or problems by raising awareness among the public, NGOs, and other organisations of possible cooperation with higher education institutions. It resulted in global inclusive cooperation between NGOs and higher education institutions, which involves an increasing number of organisations. Science Shop projects provide access to scientific and technological innovation, helping to address emerging challenges in the context of science which means all organized research, including social sciences, humanities, and arts, as well as natural, physical, engineering, and technological sciences. Nonetheless, the existence of Science Shop projects helps to shape the personal and professional competencies of young professionals, which includes not only disciplinary but also interdisciplinary thinking, and in turn, initiates new industrial revolutions in society, develops better adaptation to changes, that include the use and development of global new technologies, systematic cooperation between different disciplines, changing the regular way, methods and methods of science, their knowledge system and application, creating new products in individual cases and thus forming separate fields of science (e.g. Nanotechnology and nanoscience emerged when physicists and chemists jointly developed and applied nanostructures). It is no exception to the current situation of undergoing a collision of "Industry 4.0" technologies (Internet of Things (IoT), Cloud Computing, Big Data, Robotics, Artificial Intelligence) and "Industry 5.0" technologies (Human and Robotic Cooperation Renewable Sources, Bionics, Sustainable Agriculture), development, initiation, adaptation, and preparation for them – development of human qualities and competences. In order to clarify the link between "Industry 4.0" and Science Shop projects, a study was carried out (appendix), and two different groups were interviewed (academia and its representatives and representatives of enterprises and other institutions).

Factor D (Technological innovation) is the most important. No less important from an academic point of view is factor B (Science Shops and other projects promoting the use of interdisciplinary knowledge and research methodologies to localize and address existing societal challenges). From the point of view of representatives of enterprises and other institutions, the second most important factor is A (Personal competence of people initiating and implementing Industry 4.0 and future revolutions), and only then is factor B (Workshops and other projects promoting the use of interdisciplinary knowledge and research methodologies to localize and address existing societal challenges). The following hierarchical sequence of representatives of both academia and enterprises and other institutions coincided and ranked in the following order, from the most important to the least important: E – Individual organisation strategy and cooperative thinking with other organisations; C – Public Promotion Programmes and a clear strategy; F – The level of public readiness for innovation.

The answers of the survey respondents to the question of what in the Science Shop project had the greatest impact on the implementation of industry 4.0 and on the needs of future revolutions, and why, distributed according to the same or similar trends, i.e.:

- Initiative and competence;
- Solving real problems relevant to Industry 4.0;
- Motivation, creativity;
- Adaptation of technological innovation and of new equipment and software in the Science Shop project, the use of which can later be applied when working in the industry this way satisfying growing needs;
- The needs of the external environment for innovation and improvement;
- Mutual understanding between participants in the Science Shop, the pursuit of the same objectives, and adequate aligned understanding of the needs of the industry, which makes it possible to act purposefully to achieve the same objectives and carry out research without creating additional obstacles;
- Encouragement to use interdisciplinary knowledge to solve existing problems;
- State support as well as competence of people initiating and implementing industry 4.0;
- The accelerating pace of life, emerging areas of new activity;
- Changing engineering and understanding

Respondents‘ answers regarding personal characteristics that should be developed in Science Shops or other projects and which are necessary for industrial 4.0 and future revolutions are:

- Creativity – the ability to see the applicability of innovation;
- Collaboration and team skills,
- Research competence and insight,
- The ability to identify problems and select appropriate solutions and technological ways out, digital competencies, proactivity, critical thinking, etc.;
- The ability to analyze and predict/purify the need for a project, working in a group, logical thinking;
- Autonomy;
- Determination – desire to grow;
- Innovation, global and critical thinking;
- Capacity for innovation;
- Leadership.

Responses to the questions addressing the most successful stages of the Science Shop were categorized in the following way:

Reflections of representatives of academic society	Reflections of representatives of business and of other institutions
Selection of lecturers that lead Science Shop projects;	Cooperation;
Organisation of student team's work, pursuit and publicity of Science Shop projects' results;	Communication with external enterprises;
Publicity of the project;	Practical implementation of the project;
Transformation of an idea into a research work;	Adaptation to working with new equipment, new work organisation;
Reflections and discussion of the upcoming stages.	A decision to direct the solution the way it would comply with the competencies of those participating in the workshop;
	Organisation process

Responses to the questions addressing the most difficult to implement stages of the Science Shop were categorized in the following way:

Reflections of representatives of academic society	Reflections of representatives of business and of other institutions
Generation of the problematic aspect;	Understand competitiveness;
Involvement of social partners;	Formulation of the problem solves;
Conducting general research;	Acquisition of the necessary means;
It was difficult to work in a team, distribute tasks, elect the leader;	Problem identification and formulation;
Search for potential partners.	Highlight the final result;
	Demonstrate the need.

The aspects of the Science Shop or other projects identified by respondents, which contribute to Industry 4.0 and the pace of implementation of future revolutions, can be divided into the following groups:

- Innovative approach. Science Shop projects allow to bring together students from different study programmes and to develop projects needed by the public. Students have the opportunity to compare, improve and monitor projects. Improvement processes enable interest in and acceleration of innovation-oriented towards the implementation of the Industrial 4.0 Revolution;
- Development of competencies. Encouragement of critical thinking, competence in research, competitiveness in the market, etc.;
- Complexity. Different activities are merged to achieve a common goal;
- A new approach to engineering. The work of engineers cannot be monotonous and boring, Science Shop projects allow a choice of research, as well as an open path to technology and production and maintenance. Moreover, in such interdisciplinary projects, the student will gain experience in different spheres for the future, as modern engineers are needed in modern organisations that adapt to the latest trends that implement environmentally and energy-efficient solutions.

- Interdisciplinarity. The use of interdisciplinary knowledge.
- Solutions to society-relevant issues.
- The mindset of participants is different from that of the industry and sometimes leads to non-standard solutions;
- Communication, development of new technologies;

The negative aspects of Science Shops or other projects, identified by respondents, which do not contribute to industry 4.0 and the pace of implementation of future revolutions, can be divided into the following groups:

Reflections of representatives of academic society	Reflections of representatives of business and of other institutions
Irrelevance. Irrelevance in developing competencies and cost-effectiveness that meet future needs;	Inaccessibility to various IT software packages;
	Red tape;
Absence of motivation;	Limited knowledge of theory and practice among the participants;
Lack of information.	Fear to move forward, fear to leave your comfort zone.

Academia respondents identified two factors as the most encouraging technological innovation: competitive environment (60%) and CEOs' attitudes and corporate policies (40%). The finding demonstrates that technological investment is not affected by wage increases as well as productivity gains are not affected from the perspective of academia respondents who carry out projects. Also, respondents from businesses and other institutions highlighted the following factors encouraging technological innovations: CEOs' attitudes and corporate policies (71,4%) and the competitive environment, and the increase in remuneration by encouraging investment in productivity (14,3%). This shows that the perception of encouraging factors differs from the factors that encourage technological innovation, which in some cases may lead to misunderstandings regarding demand and other aspects of cooperation between academia, businesses, and other institutions.

Respondents responded unanimously to the question regarding the relevance of Industry 4.1 and future revolutions (100%) and claimed that the topics were relevant both on a personal and community levels.

Responses that were presented together with additional comments fell into two categories:

Industry 4.0 processes are very relevant, but they should be implemented faster in the study process. This requires very close cooperation with businesses involved in digitisation and robotisation processes; Engineering will always be a great career choice because it's a specialty that doesn't stand still and responds to the most important changes in the world.

Responses from respondents in academia were distributed as follows: 80% – the interest in Science Shops and other project activities is growing, which is a significant increase for respondents and their academic community, 20% replied that they did not know or could not name the growth of interest in Science Shops and other project activities. Responses from respondents from enterprises and other institutions were distributed as follows: 71.4% admitted that the interest in Science Shops and other project activities is growing, which is a noticeable increase for respondents and their community, 28.6% replied that they did not know or could not identify an increase in interest in Science Shops and other project activities.

The responses to the additional comments comprised one merged group – the willingness to change the training process is increasing, as well as grows willingness to make it as close as possible to solving industrial problems.

III. PREREQUISITE FOR THE ESTABLISHMENT OF „SCIENCE SHOPS”

Organisational requirements of the host institution of the Science Shop

Prior to the establishment of the Science Shops, it is recommended to evaluate the following organisational resources and competencies, that are relevant to the implementation of Science Shop activities at the HEI:

1. Human resources
2. Competencies (lecturers‘ and students‘)
3. Space in the study programme
4. Partner network
5. Material resources

1) Human resources.

Science Shop implementation requires the following human resources:

- Students – project executors;
- Mentors, lecturers-experts, lecturers, and researchers, who consult student teams and lead the research;
- Coordinator – a person who monitors the process and facilitates communication between the clients and the Science Shop teams.

As a rule, Science Shop projects are implemented by student teams, who are advised by lecturers/researchers. Depending on the model of activity, students can perform these activities on the basis of volunteering or within the framework of a specific subject of a study programme. Each student team must have at least one mentor (lecturer or researcher). Sometimes, depending on the nature and subject matter of the task, there is a need for specialist advice from several lecturers. The role of the Science Shop Coordinator, who coordinates the project from the moment the client submits his/her question/problem, is also important. The coordinator communicates with lecturers who work in relevant fields and could contribute to solving the problem, considers the possible ways to paraphrase the submitted issues into research questions that could be analyzed by students, forms student teams together with the lecturers, supervises the project implementation process and helps teams to maintain communication with the client (See section IV for details on Evaluation of the necessary preparation aspects).

2) Competencies.

The following competencies are important for Science Shop implementation:

Students:

Jau aukсčiau minėto ENTRANCE projekte The coordinators and clients of the higher education HEI's Science Shops involved in the beforementioned ENTRANCE project emphasize the importance of working on the motivation and involvement of students, as well as their commitment to the project. Also, in order to enable students to achieve the maximum result of the project, it is important to help them develop the competencies relevant to the Science Shop projects – i.e. it is important to organize student training and counseling.

ENTRANCE project was carried out in 2019 in 5 EU countries (Belgium, Finland, Lithuania, Portugal, the Netherlands), and it addressed NGO Needs. During the project, a survey was carried out (Strazdiene, 2019), which, together with community organisations, aimed at identifying students' competencies leading to a good result in the implementation of Science Shop projects. Although the competencies that are most relevant in the CSO's view have not varied significantly from country to country, it is possible to highlight general trends and identify students' competencies for which special attention is important by involving students in the implementation of Science Shop projects:

- Cooperation
- Openness and transparency
- Ability to act
- Ability to foresee future trends
- Understanding of the situation

For students, competencies of researching and project management are also very important.

Mentors (lectures and researchers):

- Depending on the peculiarities of the Science Shop project, apart from the specific specialist knowledge and research competencies, it is very important for the lecturers to demonstrate mentorship competencies:
- Ability to build rapport with a student and to communicate with him/her on the partnership level,
- Ability to encourage student cooperation,
- Ability to mediate conflicts,
- Ability to encourage a student to develop his/her approach and critical thinking,
- Ability to effectively consult a student, provide support in a critical situation,
- Ability to create a study-friendly environment that would meet students' needs.

Coordinator:

Competencies of cooperation, facilitation, and communication are of particular importance to every Science Shop coordinator. While communicating in an international environment, Science Shop coordinators often admit that because of the nature of their activities, and their distinctiveness from the regular study process, they often feel isolated, and not supported enough. It is therefore particularly important for coordinators to participate in Community of Practice at both national and international levels (e.g. Living Knowledge Network).

3) Space in a study programme.

Since the Science Shop operates as a branch of a higher education institution, it would be appropriate to foresee the subjects during which students could implement Science Shop projects. Certainly, students could also implement projects on the basis of volunteering, but in such a case, there is a high risk of not achieving project results due to declining student motivation. In the case of students carrying out Science Shop projects within the framework of their study programme, especially if the theme of the project is closely linked to their specialization, the motivation of students to complete the project is significantly higher. This relates not only to the formal evaluation of the project but also to the fact that a student does not have to specifically search for time over the study programme frames for the project, which is particularly difficult for students who work or have children.

The Science Shop project could be carried out within the framework of an optional subject, as well as a course or a Final Project. Naturally, due to the specificity of Science Shop projects (often interdisciplinary when teams are advised by several specialist mentors), the anticipation of a place in a study programme can sometimes require a different educational model, when changes affect the entire faculty or even the institution as a whole. But this usually happens at a later stage, when the Science Shop has already undergone the piloting stage and its value has been recognized at the institutional/faculty level.

4) Partnership network.

The experience of various ongoing Science Shops proves (both at the college and of foreign partners) that a website where NGOs or communities could present a problem is important. However, if the traditions of cooperation between higher education institutions and public organisations are not deeply rooted, this is far from sufficient, as organisations do not position students as a potential resource for research activities and do not trust the students to do the work efficiently, timely and in a complete manner. In this case, one of the main tasks of a coordinator becomes working with partners – building a partnership network. Experience shows that the development of sustainable partnerships takes reconciliation of the expectations of the clients and the possibilities of higher education institutions in the initial phase of the project, it is essential to help students maintain an appropriate relationship with the partners at the project implementation stage, as well as to properly communicate the results of the project to the client.

If there is no deeply-rooted tradition of cooperation between higher education institutions and public organisations in the country, it is very useful for the coordinator to develop a portfolio of projects implemented, which would be particularly helpful in dealing with new partners and explaining which projects the Science Shops are working on and what type of results the clients could expect.

5) Material resources.

At the beginning of a Science Shop project, it is necessary to plan the following material resources:

- A room for meetings where future projects could be discussed by clients and coordinators, and then by the research team with clients;
- Remuneration funds for the work of the coordinator and researchers advising student teams;
- Remuneration funds for the maintenance of the internet website, where clients leave queries about relevant issues;
- Remuneration funds for publicity activities and for information material, seeking to enhance the visibility of a Science Shop both inside and outside of the university.
- Software and other equipment required to implement a Science Shop.

Possibilities and challenges in the own institution

VTDK Science Shop was established in 2016 within the EnRRICH project, which was financed by the Horizon2020 programme. This Science Shop aimed to become a mediator between the community and the College involving students in local community issues solving through applied research. It started to work with CSOs in the Vilnius region to develop research projects suitable for students to carry out as part of their degree programmes. Since January 2016, over 45 projects were successfully finished, 15 academics and over 160 students were involved. Science Shop projects were mainly carried out in the field of Sustainable urban development and Engaging & Active Design.

When Vilnius College of Technologies and Design were first involved in the activities of Science Shops, it faced the following challenges:

- development of the concept,
- identifying the group of lecturers that would consult students,
- identifying the Science Shop cycle that would comply with the study process at the college,
- development of the problem bank and cooperation with the clients,
- engagement and motivation of the students,
- project quality assurance,
- ensuring continuity of the project.

These challenges and lessons learned are discussed in the table below:

Table 3. Challenges faced and lessons learned during the Science Shops at VTDK

Challenge	Lessons learnt
Concept development Science Shops were piloted during the Horizon2020 ENRICH project, and at the time there was no institutional know-how and a clear understanding of how they would work, what are the specificities of such projects in the engineering and design school, i.e. in what way the Science Shop projects differ from the research projects on demand.	At the start of a Science Shop the following information has to be clearly identified: • What will be the topic of the Science Shop project? Clients of what field of activity will be involved? • Is the design of the Science Shop similar to other projects that have already been conducted in your institution? What is the difference between them and what type of problems will be the subject of a Science Shop project?
Engaging lecturers who consult student teams Not having a clear operating model during the piloting phase, it was not easy to bring together teams of lecturers and students. The first projects did not take place within the scope of the subject matter of the study programme, but in a variety of formats, such as voluntary participation in the project, final project, and course work. Discussions involved 20 lecturers from all faculties of the college, but after the first meetings, 8 colleagues remained in the team with whom the first pilot projects were carried out. Despite the fact that pilot projects were carried out in different faculties in various forms, lecturers unanimously expressed their desire to meet periodically to discuss the problems they faced and possible solutions. This laid the foundation for the Community of Practice in the field of Science Shops. It should be noted that of that group of eight people, several lecturers are still working with the Science Shops, now only within the scope of the study programme – so this bottom-up approach has enabled us to choose the best staff that was most suitable to meet the needs of Science Shop projects. As no funding was provided for lecturers for supervising Science Shop projects, ways were sought to implement projects in the context of existing activities (in the course of ongoing studies, through voluntary student initiatives (StudentFormula, VTDK_Hacklab)). This limitation led to additional difficulties, since innovation, although carried out within the framework of the ongoing study programme, required additional time input and overhead funding had to be sought in order to compensate, at least in part, for the time lecturers spent working.	Prior to starting the activities, it is important to provide for financial compensation and/ or working hours for lecturers‘ who will consult students. Experience reveals that it is very important for lecturers to participate in the community of Practice, which is a source of both inspiration and support for them.

Identification of the Science Shop cycle that corresponds to the college study process Due to the lack of experience during the first projects, at the start of activities the timing of the corresponding steps was not foreseen (e.g. when to gather problems from public organisations, when to find coordinating lecturers and set up student groups, how much time is there for carrying out the research, when the results are delivered to the client and when they are made public inside the college). It took the first two semesters for the lecturers who consult students to establish a cycle that helped to better coordinate the implementation of the activities and increase the visibility of the Science Shops among college students and lecturers. This cycle is no longer relevant at present, as the model of the Science Shop organisation at the College has evolved over the past few years – Science Shops at VTDK do not function as a separate centralised unit but are now carried out in each faculty within the framework of study programmes.	At the start of the activity, it is advisable to develop a timetable that would cover the main stages and would correlate with the processes of the study institution.
Creating a problem bank and engaging with customers One of the biggest challenges faced when launching Science Shop projects is the low tradition of cooperation between higher education institutions and public organisations in Lithuania. While such countries as the Netherlands, Belgium have a decades-long tradition of cooperation, and universities there have problem banks covering hundreds of societal issues, it took quite a lot of effort at VTDK to accumulate problems. Research on the needs of public organisations and some of the causes of these difficulties have eventually emerged: such organisations or local communities usually experience problems with funding their activities, they often rely on volunteer work and, accordingly, give priority to the issues that determine their survival, the problem of carrying out research is secondary to them. Moreover, these organisations have little confidence in students‘ research abilities and are not sure that students will do the job qualitatively and to the full. In many cases, organisations are not interested only in investigating, but rather in a complex solution to a particular problem. It should be noted that organisations in Lithuania often expect students to carry out research in less than 3 months, which is not realistic because it is inconsistent with the study process and the Science Shop implementation cycle at the institution.	It is important to understand that if the country does not have a deep tradition of cooperation between public organisations and higher education institutions in the field of research, it is going to be more time-consuming to develop a bank of problems and expand partnerships. In order to achieve a sustainable partnership, it is important to coordinate expectations of project results, execution time and quality risk with clients in advance.
Student engagement and motivation Having started Science Shops without an established implementation model, it was not easy to set up student groups that would have relevant competencies needed for the implementation of the task and the completion of the project in a sufficiently responsible and motivated manner. Students, when working on such projects, inevitably face the tensions arising from the responsibility to a real client, the complexity of problems, and the specificities of working in a team. It is important to help students overcome these tensions, help them find the right working routine for their team, accept inevitable planning changes, and help maintain proper communication with their clients.	Students working on Science Shop projects must receive the necessary training to help them deal with very specific issues (teamwork, project planning, and implementation, ability to act, acceptance of change, anticipation of future trends, cooperation, presentation of work outcomes, etc.).

Project quality assurance The quality of ongoing projects still remains a sensitive issue and, despite the efforts made, the risk of poor quality of implementation always persists. In order to mitigate this risk, the following measures are applied at VTDK: • students undergo training, receive supporting methodological material and are regularly advised by the lecturers; • students receive a formal evaluation for the implementation of projects; • the results of the project are presented to the public by students (with the participation of a special commission, representatives of clients, and all interested members of the faculty community); • evaluation methodology includes process evaluation as well as peer review of team members.	It is important to provide students with methodological and counseling assistance It is important to apply an evaluation system that motivates students not to disappoint the team and the client. The risk of poor project quality always persists since projects are implemented as part of the study process. It is important to discuss this in advance with the client
Ensuring continuity of activities After piloting Science Shop projects and assessing their progress as well as the difficulties encountered, an issue of continuity of activities emerged. It was, of course, possible to continue in the same way, but the number of projects would remain low as each time there would be a question of engaging coordinating lecturers and students. It was also important to systematically address the issue of reimbursing lecturers' work and developing the respective competencies of students. Pilot projects proved to be of value for students and complied with the strategic priorities of the college, therefore it was decided by the deans of the faculties to introduce optional subjects at each faculty. In this way, Science Shop projects at VTDK are carried out on a regular basis and are led by lecturers with extensive experience in coordinating such projects, and there is room for special student training.	In case there is no additional funding for the establishment of a Science Shop unit, a sufficiently sustainable and good solution is to find a place for the Science Shop in study programmes, for example by introducing an optional subject.

Despite the challenges encountered, the implementation of Science Shop projects has opened up important opportunities (the information provided is in accordance with the data obtained by surveying a focus group of lecturers and students at VTDK in 2020):

- the development of students' research and transformative skills – 96% of students indicated that they not only gained new knowledge but also valuable experience of project work and communication with social actors, learned to work in a team, improved their planning and time management skills. 65% of students emphasized the importance of interdisciplinary learning experience gained. As most of the Science Shop projects focused on renewable energy sources, sustainable solutions and environmentally friendly materials or technological innovations, students have learned to consider decisions they take from a future perspective. For example, to think about how the solutions they currently propose would influence climate change or the reduction of environmental pollution, and how relevant they would be in a few years. Almost 90% of students indicated that the newly acquired competencies, especially in collaboration and teamwork, will be applied in their future work.

- the development of applied research and compliance with the third mission of higher education institutions – Science Shop projects are an important part of research carried out by VTDK students, which is now also included in the strategy of the college; taking an active part in the research, the results of which are relevant to society, students feel that the result of their work is part of real changes in local communities and the region and that their studies are not of hypothetical nature.
- development of institutional competence and improvement of the educational model – with the application of the iteration method the cycle of Science Shops has been monitored each year and possible improvements to the model have been discussed; as a result, each faculty of the College offers students an optional subject which allows carrying out interdisciplinary Science Shop projects. It is worth mentioning that in each faculty the Science Shops have acquired slightly different features, e.g. students at the Faculty of Civil Engineering generate innovative concepts of responsible innovation (an optional subject Responsible Innovation), students at the Faculty of Design work on art projects, students at the Faculty of Technology are focused on solving specific problems local communities face. In addition, the Faculty of Technology introduced another optional subject, "Interdisciplinary Project", which engages students from different study programmes (including engineers and designers), and where students sometimes continue to develop the results of Science Shop projects, focusing on technological solutions. In all faculties, Science Shops have links to other study subjects, and study programmes allow more space for interdisciplinary training.
- improving the image and reputation of the College – consistent work with partners leads to sustainable partnerships, e.g. some clients have applied for research implementation more than once; such cooperation helps to develop a network of social partners and improve relations with existing ones, which also contributes to improving the college's image in the region. Moreover, regular presentations of the results of the projects implemented and of the method itself through conferences and other events are of interest to colleagues, encouraging the mutually beneficial exchange of ideas and participation in new projects.

Needs of community-based organisations (CSOs)

The growing complexity of current societal challenges makes us realize that collaboration of universities and society representatives – civil society organisations (CSOs) is more important than ever. Higher Education Institutions (HEIs) can have an active role in helping civil society organisations (in the broadest sense, including NGOs, associations, local communities, etc.) to surpass the lack of research expertise and resources while engaging in relevant research their students and staff. But what are the actual needs of CSOs in terms of societal research questions that could be answered by higher education students?

To gain more insight and better understand the current and desired collaboration between CSOs and HEIs in terms of research, in 2019 CSOs needs study was conducted in 5 countries within the European ENtRANCE project with the support of the Erasmus+ programme of the European Union.

Profile of the civil society organisations

The CSOs needs study consisted of CSO online survey (255) and interviews (40). In the online survey, CSOs were mainly represented by associations (58%) and NGOs (29%). Almost half of the respondents were very small organisations having less than 5 employees, however, the other half are larger organisations having more than 10 employees; the vast majority of CSOs are working with volunteers, which has crucial importance in terms of non-sufficient sustainability of activities.

The respondents mainly carry out educational activities, support people, and submit suggestions on regulatory documents or policies, but they rarely or never take judicial actions, protest or start debates. This would reflect that CSOs are very hands-on within their own domains or fields and rather do the actual work than try to affect the circumstances behind the societal issues.

Difficulties encountered by CSOs by addressing societal issues

Participation/activation of volunteers

One of the difficulties mentioned was finding people to participate in their activities. Sometimes the challenge was to recognize the target group they wanted to include in the activities and sometimes it was the motivation of people to join the activities.

The motivation and participation of volunteers in the events or projects were also seen as a challenge. When one does not get paid or is not required to work on a project, the question is, how to manage and motivate them?

Collaboration with many different stakeholders

When it comes to a CSO, there are always several stakeholders in play. There are the FTEs and volunteers working for the CSO, the association members, the people who participate in the events and activities organized by the CSO, and the funding source for the operations. Navigating and managing these stakeholders can be challenging at times and producing meaningful content and activities to satisfy all of them is very often difficult.

Funding

In the interviews, funding was found to be one of the difficulties. The CSOs often thought it did not make sense for them to have to apply for and justify funding on a regular basis even when they were providing services that the municipality or government should have offered. They felt they were filling the gaps left in the governmental and municipal services and that they still had to almost beg for funding from charitable funds and other sources.

Innovative thinking

One of the difficulties for the CSOs was innovative thinking and ways to redefine their activities. In some cases, there is a culture of doing things exactly the same way they have been done before. The interviewees thought that this was difficult to shake. Also, defining the activities and in some cases, the target groups of the activities in a new way was also found difficult. The question was, how to design the services in a new way and involve people from different kinds of backgrounds in the activities.

Time management

This aspect is a problem that both speaks for and against the collaboration with HEIs. The CSOs wanted and were interested in doing more research but had no time for it because the staff did not have any time allocated to that. This is because there are not enough resources to hire paid staff and volunteers are difficult to find. On the other hand, even with the research collaboration, the CSOs were worried that they would not have enough time to supervise and accommodate a student researcher. They were very aware of the benefits and willing to work with HEIs nevertheless.

The needs

68% of respondents admitted they needed to conduct research in order to address societal challenges. The reasons for doubting collaboration vary from time management issues to past experiences and also not being sure if students could handle the issues in a sensitive and discreet manner.

A very important finding is, that the research problems that the CSOs usually face are complex and mainly require expertise in more than one academic discipline.

CSOs consider that 5 top skills in order to be able to tackle research problems are as follows: collaboration, openness & transparency, action skills, skills to anticipate the future, and situational awareness.[1]

1. Tassone, Eppink. (2016). The EnRRICH tool for educators: (Re-)Designing curricula in higher education from a "Responsible Research and Innovation" perspective. Retrieved from: https://www.livingknowledge.org/fileadmin/Dateien-Living-Knowledge/Dokumente_Dateien/EnRRICH/D2.3_The_EnRRICH_Tool_for_Educators.pdf

Interviews revealed that the possible future trends of collaboration between CSOs and HEIs in terms of research are as follows:

- ***Impact studies***

Impact studies were mentioned in nearly every interview. CSOs find them very useful when planning their services and activities. Impact studies can also be used to justify funding when applying for it.

- ***Knowledge sharing***

This is both an ongoing trend and also a sought-after future trend. The CSOs either had already an ongoing collaboration with HEI to exchange knowledge that went both ways, or they wanted to establish collaboration in this area. In this case, knowledge sharing means having an exchange of expert lecturers both ways: the HEI can offer lectures in the CSO activities and the CSO can also lecture within the HEI in their own area of expertise. Knowledge sharing also means research collaboration. Innovativeness and thinking outside the box were also mentioned as a strong benefits of working with HEIs.

- ***Product/service development or design***

The CSOs already had a vision of developing some new services or they wanted to research their existing ones and how to make them better. The development ideas varied from products to activities and services to offer to the people who participated in the functions. The products and services mentioned were intelligent technology to track usage of a pedestrian/bicycle route, a virtual service to participate in the hobby activities, and a service or system to acknowledge the skills acquired while participating in the hobby activities.

It would be also worth mentioning some findings of the Impact Study, carried out within the same ENTRANCE project. During this study, civil society organisations were interviewed in Netherlands, Belgium, and Finland in order to get to know what is the value of Science Shop projects for them. So CSOs appreciate Science Shop projects because:

- they offer free research and time,
- they are based on a (sometimes seldomly earlier researched) topic originating in their community/practice and because it's scientifically valid,
- they welcome fresh student ideas and perspectives.
- because of the structured process, coordination & administrative support they offer, together with care & enthusiasm
- they also appreciate the project flexibility along the way and welcome new insights and developments but combined with academic time schedules this also implies the danger of delay in their opinion.

It is also important to note, that despite the common trends, usually there is some specific context caused by cultural background, collaboration traditions, and financial issues. For example:

- In all countries, the majority of respondents partly use volunteer work. But in the Netherlands this trend is the strongest – 88% of Dutch CSOs participating in the study were organisations without employees based ONLY on voluntary work.
- The question, of whether they need research for their work, was answered positively by 68% of the respondents. However, in different countries, we could observe different trends. In Belgium and Portugal, the vast majority of the respondents believe they need research for their work. Whereas in Finland, Lithuania, and in the Netherlands only half of the respondents indicated they deal with research activities addressing societal challenges. The same situation we observe by examining CSOs‘ willingness to collaborate with HEIs in terms of re-

search. 84,6% Belgian and 84,3% Portuguese respondents were very enthusiastic regarding possible collaboration, whereas, in Lithuania, Finland, and the Netherland nearly half of the respondents expressed their doubts about such collaboration. These trends are reflected in the number of research topics, offered by CSOs (see question 17).

- Speaking about financial compensation of the small cost incurred by a research team, the situation is different again: in the Netherlands, Belgium and Finland CSOs are rather willing to cover small costs, but in Lithuania and Portugal vast majority of respondents would not agree to compensate the costs of a research team.
- There are clear differences in terms of expected research duration. A clear majority of Belgian (80%), Portuguese (68%), and Finnish (60%) respondents find that the research could take more than 6 months, whereas two-thirds of Lithuanian CSOs (65%) would like research to be finished within 3 months. Opinions of Dutch respondents in this question were distributed evenly. These specialties of national contexts should be taken into consideration by HEIs willing to collaborate with CSOs and thinking about their organisational models.

The recommendations, developed for HEIs by the research team were as follows:

- **If possible think of offering a complete solution** – CSOs are more likely to expect not only some research but rather a solution to some particular problem they face – suggestion for a new model, a creative solution, etc. Thus HEIs could think about the embedding of educational models allowing them to combine research and action resulting in a solution to societal problems.
- **Be proactive** – Due to a lack of previous collaboration experiences in the countries where the Science Shop model is relatively new, it is less likely that CSOs will ask universities to help, so universities should be proactive by establishing cooperation.
- **Apply tailor-made communication** – by approaching CSOs it is important to remember that they lack time due to the problems with human resources. So it would be important to be aware of the domain and activity of the particular CSO and apply tailor-made communication. For example, it would be beneficial to create targeted messages to the CSOs in different domains and ask them about their needs with some open-ended questions in order to find out their specific needs.
- **Help to formulate a research question** – some CSOs need help with the formulation of a good research question (starting from the concrete societal challenge they face): the lecturer or Science Shop mediator should help the CSO with this. In some cases, it could also help if HEI would not ask to identify a research problem, but would just observe organisations‘ daily activities, would have a conversation with CSOs representatives, and then would „translate“ their findings into research problems.
- **Help students to maintain a proper communication style** – in order to keep the process smooth and build trust, it is necessary to teach students how they should work with CSOs in terms of communication, ethics, and time management. In this, it also helps to have one person in charge (e. g. Science Shop mediator) and communicate with the CSO in addition to the students conducting the research. CSOs have mentioned it would be important to increase their general visibility in the society and proper communication of research findings could contribute to it. So it would be helpful to teach students how to efficiently introduce their research results to a broader public.

Impact on teaching materials, successful preparation of lecturers

In order to evaluate participants‘ experience, and understand the need for teaching materials, lecturers supervising the Science Shop project over the period of the last 4 years were invited to a discussion (7 lecturers participated):

- Lecturers noted that it was rather challenging to work with CERL (community-engaged research and learning) projects. However, in the cases when the idea was implemented in practice and demonstrated its value, it proved the importance of such projects, which is very satisfying for both lecturers and students.
- Lecturers noted that students‘ engagement was very varied. Some students gladly got involved and started their projects, others for a quite long time were struggling to choose the problem they would like to work with. One of the major challenges for students was a collaboration with the civil society organisations (CSOs); they also often feel shy to present the result of the project to the public.
- Lecturers acknowledged that by supervising CERL projects, they improved their skills of interdisciplinary teaching and collaboration competence, found out what problems CSOs and communities face, and better understood their needs. Lecturers also mentioned that quite a challenge was the fair and motivating evaluation of the students‘ team.
- The collaboration process with CSOs is one of the biggest challenges both for students and lecturers. It would be helpful to strengthen cooperation between CSOs and HEIs step by step building mutual trust and developing collaboration tradition in terms of community-engaged research and learning projects. For that purpose, it is important to increase the visibility of already implemented projects in order to give CSOs an idea of what they could expect.
- Transdisciplinary learning is a very important aspect of community-engaged research and learning projects, so it would be important to support lecturers in terms of methodological tools, sharing best practices, and creating opportunities for organizing such learning.

So it is evident, that taking into account the real-world oriented often interdisciplinary nature of Science Shop projects, methodological support is important both for lecturers and students. However, what kind of teaching material it will be and how lecturers should be taught depends heavily on the context in which the Science Shops operate in a given institution.

In 2018-2020, as part of THE ENTRANCE project, higher education institutions from five countries developed teaching materials for participants in Science Shop projects. During the project, partners discussed whether unified material should be developed or whether each institution should produce the training material best suited to its context. The second option was chosen. Interestingly, the consortium went exactly this path, albeit the main set of student competencies that were built in the course of the investigation to all parties was similar (cooperation, openness, and transparency, capacity to act, ability to anticipate future trends, perception of the situation).

By the way, the experience of all five HEIs shows that for the lecturers was an extremely important Community of Practice – when lecturers, sharing a common interest (Science Shop) come together for active learning through the process of inquiry, sharing their best practices.

The further part of this publication presents learning material that could be relevant to lecturers and students who participate in Science Shops.

Drawing on identified CSOs‘ needs regarding students’ competencies needed in order to conduct research or community project addressing societal problems, VTDK developed a tailor-made learning material in 2020.

VTDK training materials (Lithuania):

VTDK training materials were developed to increase students' engagement and to support lecturers who would like to set up a Science Shop project addressing societal issues in the frame of their course and based on community-engaged research and learning (CERL).

Learning materials were developed as a toolkit based on identified CSOs' needs involving students' competencies needed to conduct research or community project addressing societal problems. The toolkit contains a tailor-made selection of concise materials addressing specific questions:

How to run a Science Shop project?

How to approach CSOs and identify societal problems?

How to transform practical problems into a research question?

How to transform a problem into a project and develop a solution?

How to make the results of the research/project visible?

How to evaluate students in order to increase their engagement and motivation?

The learning material can be used by Science Shop coordinators, lecturers, and students; it helps to develop the following competencies: collaboration, action skills, situational awareness, ethical thinking, skills to anticipate future trends, openness and transparency.

https://en.vtdko.lt/international/international-projects/187-entrance-engaged-research-connecting-community-with-higher-education

VUB, Belgium:

VUB training modules aimed at lecturers:

Module 1: Design of a CERL course

Module 2: Preparation of a CERL course

Module 3: Execution of a CERL course

Module 4: Completion of a CERL course

https://trello-attachments.s3.amazonaws.com/5f91d3343822d51bec037e78/5f9313ad58dfd318c277915d/4148bc73d45efa4cb6fceb9dabe2bd2b/VUB_CERL_GUIDE_-_DESIGN.pdf

WUR, Netherlands

Students working on Community-Engaged Research and Learning (CERL) can use this material when they want to create a project proposal for defining and addressing, in an academic consultancy fashion, a specific query or challenge faced by societal actors (the commissioners of the project). This Handbook includes steps for the development of a successful project proposal, including objectives of each step, exercises, links to video clips, self-evaluation guidelines, etc..

https://trello-attachments.s3.amazonaws.com/5f91d3343822d51bec037e78/5f9311430f54154c78a93ccc/7ace7ec6a15961b0f182fdc97025d08c/Handbook_Developing_an_Academic_Consultancy_Proposal.pdf

IV. ONGOING SCIENCE SHOP PROJECTS

Evaluation of the necessary preparation aspects

The experience of the lecturers in charge of the VTDK Science Shop has proven that one of the main and fundamental guarantees of successful implementation of the Science Shop project is the proper preparation of all project participants to implement the Science Shop project: from a team of students, clients (NGOs, etc.) to lecturers-researchers, lecturers-consultants or experts who provide the information and recommendations required by state-of-the-art technology and practical insights to a group of project researchers (according to the nature and specificity of the Science Shop project).

The initial stage of project initiation is crucial for the qualitative result of the Science Shop and for the timely implementation of the project. It is closely linked to the search for a relevant and research-requiring problem, the identification and transformation of a specific research problem into a study question/project topic. At this stage, the needs and expectations of the client are also identified, special temporary organisational structures are created (one or more project groups/teams are formed), responsibilities and functions of the project group members are allocated, initial project planning is started and the project direction is established, etc. Therefore, inadequate or insufficient preparation of participants at any level of the project may result in an inadequate outcome of the study carried out both during the project and during the Science Shop, distorting or modifying the solutions and the general objectives pursued.

One of the first major challenges faced during the Science Shops (and, at the same time, the guarantee of success) is the need to bring together citizens and/or their organisations, to find a common ground with regard to their needs, to the problematic issues demanding research, and the interests and possibilities of the researchers concerned. Therefore, prior to the start of the Science Shop, it is essential to prepare, evaluate, and consider a number of key elements and issues. For example:

- is the community problem relevant to an educational institution?
- can the problematic issue be addressed by a Science Shop and research?
- is the educational institution able to carry out research, the results of which would be adapted to find a solution to the problem?
- are there any Science Shop projects that have already been implemented in the educational institution, and the results of which could become a solution to a problem of public interest; are there any Science Shop projects dealing with similar issues that could have continuity?
- is there a multi-faceted solution to the problem, using knowledge from different backgrounds or addressing the problem from different scientific points of view, promoting student interdisciplinary thinking and multidirectional or complex vision of the solution to the problem? Who is to be the main researcher? What knowledge and competencies should the researcher have?
- What should be the level of cooperation with the client (does the client participate in the research and separate stages of the Science Shop project, does the client only express its expectations and preferences for the desired result, participate in part or only in one activity or in a specific study, or participate in all activities, and is a leader, etc.)?
- what are the Science Shop project participants' knowledge, skills, and abilities regarding cooperation? What are their strengths and weaknesses?
- what target group is planned to be included in the Science Shop project? What target group do the results of the Science Shop project address?
- what could encourage the involvement of scientists and researchers in a concrete Science Shop project?
- what infrastructure, what means, what material and human resources are required to implement a Science Shop project and its separate activities (including aspects of communication, data collection, and feedback)?
- other questions.

Answering such and similar questions helps to evaluate the real situation and possibilities, and to assess the participants' initial preparation for a Science Shop project. Science Shops must be easily accessible to all stakeholders (through a website, account, social networks, etc.), their results widely applied, and researchers must have scientific experience and competencies, enthusiasm, and excellent communication skills. The preparation of Science Shop projects at the level of the educational institution is thus an important element of the preparation for the Science Shop project. For example:

- it is recommended for the educational institution to develop general project forms (templates) which could be used in all Science Shop projects carried out at the institution to facilitate the planning of each project, coordination of activities, etc. (Some examples of such forms (templates) are presented in the other part of this publication and in its appendices);
- another recommendation is to create a bank of ideas/problems; it is used by potential clients to present problematic issues or ideas (suggestions, needs, expectations) and by students to identify problematic aspects or topics that require research that have been revealed during the pilot study at the initiation stage of the Science Shop, etc.;
- lists of experts, lecturers-consultants, and lecturers-researchers could be compiled so that before starting the Science Shop it is known what kind of research can be carried out in the educational institution and what competencies of lecturers can be involved in a specific Science Shop project;
- new lecturers joining the Science Shop undergo training, during which the best practice is shared by the lecturers, students, and representatives of the clients

coordinating or participating in the Science Shop projects, etc.
- arranging additional professional development and professional field events.

Student participation in the Science Shop is not recommended earlier than mid-term, i.e., students should have already acquired general competencies and specialty knowledge, although Science Shop can be selected as an additional or an optional subject that does not require any skills and competencies to conduct research or carry out project activities (e.g., first-year students choose to participate in a Science Shop project, although they have only just started their studies in a higher education institution and have no experience of participation in similar projects or in research activities, as well as no general specialty knowledge and research experience yet). However, some aspects, such as knowledge, skills, and abilities to carry out research, are required and often essential for a successful and qualitative implementation of the Science Shop project.

Recommendations for the team of students participating (planning to participate) in a Science Shop:

- before the start of the project, to have completed a course in such subjects as Applied Research or Project Management, as they provide basic knowledge on research design, sampling, methodologies, validity, adequacy of data, project organisation, milestones, risk evaluations, etc.
- to have acquired knowledge in engineering, social sciences, business, etc. (depending on the nature and specifics of the Science Shop project), so that during the project students could not only apply various research methodologies and tools but also organize the research itself as professionally as possible, understand the essence and expediency of the carried out research.
- to have participated in creative workshops, international projects or summer camps, to have undergone special internships or apprenticeships, during which professional knowledge, the experience of international communication and cooperation is gained, in-depth aspects of teamwork are understood, etc.
- to have experience in carrying out research at the institutional or international level, participating in scientific projects or various research activities (commissioned projects, experimental development projects, etc.), or conducting research under different methodologies and of different nature (e.g. pilot study, experiments and tests in laboratories, social research based on interviews or surveys, etc.), in data processing, systematization, and presentation, participation in projects with the community to address local problems (e.g. science workshop projects, social projects, deep volunteering activities).
- to have experience in presenting and otherwise disseminating the results of research and project activities, preparing scientific articles or presentations at conferences, science festivals, and other events aimed at presenting research results and achievements (e.g. in a market for research projects/ideas where projects/ideas are presented and potential clients or partners can choose the projects/ideas they like).

Knowledge, skills, and abilities are also required when planning a project budget (estimate), preparing visualizations and project documentation, etc. Therefore, knowledge of computing, layout design, and similar programs is also an important aspect of preparation for the Science Shop. Foreign language skills, as well as communication and cooperation competencies, are also required when working in international, mixed or interdisciplinary teams in Science Shops.

Recommendations for the lecturers (lecturers-consultants, lecturers-researchers) and experts participating in the Science Workshop project:

- prior to participating in the first Science Shop undergo a short introductory training course, during which a coordinating lecturer and other lecturers experienced Science Shop procedures share best practices, recommendations, and insights on the features and specifics of a Science Shop, provide examples of various situations, possible solutions, mistakes, etc.
- to have participated in Science Shops or similar projects and activities and have personal insights and experience in solving problems relevant to society when research is used for finding solutions.
- to have carried out research or participated in research projects or various research activities, prepared scientific publications, or presented reports at national and international level events.
- to have cutting-edge knowledge and competencies in the specialty field, professional and practical experience in the field of the scientific interests, which is indicated in the documents of qualification upgrading, reflected in available publications, recommendations, methodological materials, and preparation of methodological tools, etc.
- to be enthusiastic, interested in innovation and the latest scientific achievements, to have appropriate communication and collaboration skills for working in teams and carrying out project activities, etc. Foreign languages, psychology, and similar knowledge are also important.

Clients that actively participate in Science Shops are recommended to have experience in conducting the research and putting its results into practice; however, if the client‘s representatives are not directly involved in the Science Shop, additional research experience is not a prerequisite. In such a case, a client is concerned with the solution to the relevant problem and the practical application of the research result.

Recommendations for the participants with no prior experience and preparation for Science Shops:

- students are recommended to choose a Science Shop as an additional or optional subject only in a higher study year when they have developed at least the basic specialty knowledge and research competencies, required for the Science Shop project. First-year students should choose additional studies of subjects required for Science Shop projects, join a team of researchers or a group of research projects, and conduct research in the context of various study subjects.
- lecturers are recommended to undergo a short additional training course with the dissemination of good practice before the first participation in the Science Shop; to participate in qualification upgrading events, training activities, in-house research or to initiate it together with competent and experienced researchers; to conduct pilot, exploratory, social research (surveys, interviews), etc. in the context of the subject they teach; to monitor the ongoing Science Shop projects (lecturer-observer, lecturer-assistant), to participate in project publicity events, to consult students and other lecturers conducting research or solving problems relevant to the society in the context of their subject.
- clients are recommended to more actively participate in events organized by the educational institution and in presentations of Science Shop projects, to initiate joint research with at least minimum participation in one or more project activities/research, to raise problematic issues and discuss them with a competent team of researchers.

Develop recommendation for action plan for implementation and operation of Science Shops

Vilnius College of Technologies and Design has been implementing Science Shops since 2016 as part of the project Strengthening Responsible Research and Innovation in Higher Education through Study Programs funded by the European Union research and innovation program Horizon 2020, thus, lecturers-researchers have accumulated sufficient knowledge that allows to single out the key aspects of planning and implementing Science Shop projects.

First of all, before making any recommendations for planning and implementing Science Shop projects, it is particularly important to emphasize once again that Science Shop projects at Vilnius College of Technologies and Design are perceived as projects in which students conduct independent and free of charge research. This responsible research is conducted exclusively in the ‚real life' context and addresses societal challenges faced by communities with real research needs, from civil society organisations and business establishments to individuals.

Every Science Shop project is a complex activity and undergoes several key phases in its life cycle to achieve its unique goal. Although names, numbers, and sequences of project phases can be different in various Science Shops, a clear, specific process structure always remains the same. Vilnius College of Technology and Design implements its Science Shop projects in the following main phases: initiation, planning, implementation, monitoring, completion, and publicity:

Initiation phase is most closely related to the search for a potential client, the identification and transformation of a specific problem into a research/project topic, and the formation of a team of researchers.

One of the most important aspects of an interesting and successful Science Shop project, the research results of which would meet expectations, is finding a suitable client.

- If no problematic issues that would be relevant to one or another potential client are registered in the bank of problems/ideas formed at the educational institution (or those registered are not compatible with the research experience of the educational institution, etc.), it is recommended for the coordinator of the Science Shop to discuss with the students participating in the Science Shop other possibilities for finding a client for a project. A Science Shop project may have one or more clients (depending on the need, the specifics of the project, and the scale and relevance of the project). It is recommended to search for a client through various channels, means, and methods: social networks, professional field publications, registers of communities or organisations (e.g. NGO atlas: www.nvoatlasas.lt), review a list of social partners of the department and cooperation agreements, etc. A table of potential partners for a Science Shop project must be filled in, indicating the main general data about the client, problematic aspects, the need for research, etc. After selecting a specific (or several) client (s) for a Science Shop project, the Stakeholder and Public Interest Card will be completed. If a real client has been found, a card for planning client impact has to be completed.
- When there is a real client, it is recommended to discuss and agree upon who will be responsible for implementing project activities (initiators-coordinators) and who will be the project partners at the phase of initiating the Science Shop, especially in the case of several research groups or several clients involved in one Science Shop project. Regardless of the number of research teams and the number of clients in the Science Shop, all members of the project are equally responsible for the

implementation of the project and its results (although the general interest of each participant in the Science Shop may be different, each member is assessed at a different level. (Arnstein, S.R Ladder model): from low to moderate to high participation, but useful and positive). It is the communication and collaboration between the participants in the Science Shop that is the key to not only fostering partnerships and communication, engaging different audiences during the different phases of the Science Shop project but also contributing to the goals and sustainability of the Science Shop. Such general communication aimed at a specific goal must be specific, measurable, accessible, and relevant to all participants in the Science Shop within a limited timeframe.

- When there is a potential client of the Science Shop project, it is recommended to conduct a survey (interview) to identify problems the client face and expectations for the results, distinguish a specific problem relevant to society and transform it into a research/project topic. During the survey (interview) it is recommended to ask general questions which would help to identify the problem, and in-depth ones, aimed at revealing both the specifics of the problem and individual problematic aspects requiring research. Surveys (interviews) can be carried out using standardized questionnaires prepared by the educational institution as a general form (template) for all Science Shop projects, or designed for each project individually, taking into account the research experience, needs, and specificity of the Science Shop.
- If for some reason it is not possible to identify a problem relevant to society (for example, when no problems are registered in the problem/idea bank, there is no potential client, or the latter presents a very abstract or very narrow aspect of the problem that can be minimally solved through research, etc.), it is recommended to search for project ideas (problems) when organizing students for working in groups. It is recommended to search for the problematic aspect in groups through various channels, means, and methods: exploiting articles that address current problems and issues in society, published on social media, conducting short surveys (interviews) among various social groups (or study group members, etc.), to identify problems which they encounter on a daily or immediate basis (survey among passers-by, survey on survey websites, social networks, etc.); carrying out an analysis of scientific publications and scientific works in order to identify the problems under consideration, to select a specific field and to perform its analysis (e.g. in the construction sector, in the transport logistics market), etc. All identified problems can be placed in one folder or document, thus forming a separate group, semester, faculty, and so on. an internal cumulative bank of ideas/problems that can be used by all participants in a Science Shop – a problem identified by one group of participants can become a starting point for other participants in the Science Shop generating a project idea. When organizing group work, participants are encouraged to work together, coordinate their efforts, perform in a team, find the most acceptable way to pinpoint a problem, use non-traditional approaches and creative thinking (e.g. brainstorming, mind mapping, for-against arguments and discussion, method 'six hats' where participants have to consider the same problem from different perspectives and points of view, etc.). Identifying the problem serves as encouragement for students to become even more involved in the project management process and promotes their active involvement

in the project, improves relationships and ensures closer interrelatedness, and increases trust in each other as well as awareness of the importance of their contribution to the project.

- It is recommended to describe the refined project problem by providing clear facts and arguments, research data, etc., including quotations, explanations, and sources of information.
- Having identified a problem that is relevant to society, and a solution that requires research, it is recommended to form a team of 3-5 researchers, appointing a function of a Science Shop coordinator to a person with competencies and practical and professional experience (a lecturer, a student, a representative of the client) who would initiate and coordinate project processes, discuss with the project participants the direction of the project, agree on the rules, functions, and responsibilities of those working in the project group, etc. The coordinator forms a team of researchers, the members of which would equally participate in planning and implementing activities that develop project results, self-evaluating and evaluating each other, and ensuring the dissemination of project results. The coordinator also foresees the need for lecturers-consultants, experts, etc. Thus, the coordinator of the Science Shop project (usually the lecturer-coordinator) is responsible for activities such as initiation, coordination, planning, collaboration, implementation, self-evaluation, project evaluation, dissemination of research/project results, and so on.
- In order to determine the roles and responsibilities of a Science Shop project team, it is recommended to carry out an evaluation of skills and competencies (the next section of this publication discusses how to do this, and the annexes present general forms (templates)). It is recommended to systematize the results of the evaluation, create a model in individual cases, and visualize it, providing the most useful main and secondary aspects and directions for the project.

Planning stage begins after identifying and refining a topic/research question for a Science Shop project. During this stage, the initial Science Shop project plan and the implementation schedule are developed.

- It is recommended to foresee the duration and scope of the project during the planning phase of a Science Shop. It is recommended to link the duration of Science Shop projects with either the duration of the semester or with an intensive course, depending on issues a real client, when the whole group works only on a Science Shop project, without postponing its implementation activities after main study activities, and not coordinating Science Shop implementation with the main semester activities during the intense study process period (e.g. during few-month internships, during creative workshops or scheduling the semester process in several stages of the cycle, when all study courses are presented in an intensive manner during part of the semester, the rest of the semester devoting to all the stages of a Science Shop project). Scope of a Science Shop: it is recommended to either address one problem in one project and focus on its in-depth solution, or the complex solution to several intertwined problems, or the solution of one problem in a complex way.
- The planning phase of a Science Shop project should be used to identify the project participants and target groups, to evaluate control and evaluation measures and risk cases, to foresee possible research, and to formulate the main goal and objectives of a Science Shop project, results. It is also suggested to foresee one purpose and several quan-

titatively and qualitatively measurable goals that can be achieved after the implementation of the planned project. The latter can also be defined as certain activities or processes that will help to achieve and to implement the purpose. When formulating goals and objectives, it is recommended to follow the requirements applicable to the wording of these parts, when the wording starts with a verb and the wording itself is short, clearly revealing the essence. Project activities and their number have to be planned according to the set goals – the project may involve several different activities that meet the objectives or implement one complex activity covering smaller project activities (e.g. research activities where several research methods are applied; methods the results of which complement each other and allow a broader understanding of the issue at hand; organisation of a science week with conferences, competitions, training, educational trips, experiments in laboratories, etc.). There can be no fewer activities than goals, i. e. no goal can be formulated if no project activities are foreseen for its implementation. The results of a project are usually related to the solution of the problem that a project addresses, so the final results of the Science Shop project should be clear and measurable, necessary, sufficient, useful, and substantially justify the costs (a project group is recommended to visualize the project intermediate and final results). When planning a Science Shop project, it is recommended to establish in advance the relationship between the project goal, objectives, activities, and results. Thus, it is necessary to answer questions such as „Do the project activities contribute to solving the problem?“, „Will the project activities and the ongoing research meet the needs of the participants?“, „Will the project objectives achieve the project goal and result?“, and so on. It is recommended to do this in groups of students during situation modeling tasks, goal and task formulation exercises, and so on.

- Planning phase of a Science Shop project should also see the evaluation of the necessary tools and resources (create a preliminary project budget) and planning of the project budget in detail, from minimum costs such as paper, copying or printing services to speakers, research costs, etc. For each project activity, a detailed list of items or services needed for implementation should be compiled, indicating prices obtained from actual vendors at the project budgeting date, and not preliminary. The justification of the estimated costs shall be accompanied by an active link to each product or service. If necessary, the budget can be estimated using programs that are created for financial estimates, etc.. Finally, the foreseen funding sources of the project are presented: during a Science Shop project, funds can be earned, received from sponsors or self-financed. If the funds required for the project are earned or received from the sponsors, when describing the essence of the project, it is necessary to indicate how the funds are generated, and who are the intended sponsors of the project (funding sources).
- When planning a project, it is recommended to create a planning card for the Science Shop, giving general information such as the title of the Science Shop project (it is recommended to formulate a short, clear and memorable, meaningful, and attractive, so it would reflect the essence of the project), the project implementation period and the purpose of each project stage, activities/actions, participants, budget (the need for funds), duration and scope of implementation. It is also recommended to prepare an initial description of the Science Shop project, which would make it

possible to compare the initial and final stages of the Science Shop project after the implementation of the project and correlate them with the Science Shop project report. Such a description should not only provide general information about the project but also describe the initial vision of the project: what problem is addressed, what are the purpose and objectives of the project, what are the project phases (stages), what are the client's needs and expectations, what results are expected, what research is foreseen, etc.

- Together with the description of the Science Shop project, it is recommended to develop a project planning scheme and prepare a project schedule, etc. This helps to plan the project in a clearer way and to evaluate more aspects of the project implementation, to act more consistently, to achieve the results of the Science Shop project. For Science Shop planning and schedule development, general forms (templates) prepared by the educational institution and used for all Science Shop projects, planners as well as standardized MS Excel templets, etc. can be employed, selecting the most appropriate project time planning method for a project (e.g. Gantt chart showing the breakdown of project activities, their start, duration, and end, as well as the person responsible for carrying out a specific activity). It is recommended to identify only the most general and important stages of the project in the project scheme, this way visually and cyclically planning the course of the Science Shop project and anticipating the sequence of activities. The project schedule (timetable) should set out all stages of the project from its initiation to completion and publicity, indicating the start, duration and end of each stage of the project, the member of the research team responsible for the implementation of the activities. When compiling the project schedule, it is necessary to assess the complexity of each activity, as well as the required financial, technological, human resources, etc.
- When planning a Science Shop project, it is also recommended to perform an analysis of possible deviations from the established plan and schedule, to assess the risks of the project. The risk evaluation should identify how would a project be affected if the activities were not implemented, partially implemented or not all of the planned implementation indicators were met (e.g. if the original project plan included a scientific conference, it would be replaced by creative workshops, and projects prepared during these workshops would be exhibited and/or take part in a competition). Once the potential risks have been identified, a risk management plan (based on the needs and specifics of the Science Shop project) can be developed after assessing their probabilities and impact on the project.

Implementation stage of the Science Shop project is aimed at implementing project activities according to the schedule (timetable) established in the planning stage; the implementation of the project is monitored (interim progress evaluations, etc.).

- It is recommended to organize the implementation process of the Science Shop project in such a way that the participants of the Science Shop acquire knowledge, skills, and abilities in practical (creative, research) activities, developing the already existing experience.
- While implementing a Science Shop project, all project participants and stakeholders are expected to cooperate and recommended to follow the pre-established plan and project schedule; the

project coordinator or another assigned person should monitor the progress and activities of the project, organize interim discussions of the results and their impact at least several times throughout the whole project implementation period at a pre-scheduled time, to assess the risks in the event of changes in circumstances and to make adjustments if necessary. It is recommended to choose several different quantitative or qualitative data monitoring methods to monitor and assess a specific aspect of the project implementation.

- During the implementation phase of a Science Shop, activities of a project are carried out and the planned research is conducted according to the pre-defined research methodology, scope and nature. A Science Shop projects usually use various research and their combinations, such as qualitative-quantitative-combined (mixed), exploratory-primary-secondary, various research methods are can also be applied: surveys, questionnaires, interviews; expert method; historical research; analysis of documents and content (research in the field as well); comparative and analogy analysis; case study; experiments; laboratory tests; simulations; monitoring; activity analysis; multicriteria analysis, etc.

During the completion and publicity phase, the implementation of a Science Shop project is completed, the results of the project/research are presented to the client, and the project is publicized in various ways and by different means.

- Upon completion of the implementation of a Science Shop project, a description (report) of the Science Shop project is filled in, which can be submitted together with other results to the client. The description (report) should provide not only general information about the project, but also a detailed description of the project problem and justification of research needs, identify the target groups of the project, reveal the innovativeness of the project, provide a detailed description of the research carried out during the project, highlight and describe the results of the project, provide annexes to supplement and substantiate the information provided in the report (e.g. client, expert, etc. (as appropriate) survey/interview questionnaire template and data summary and analysis, budget for the implementation of a Science Shop project (estimate), description and report of the study (ies) with summary and analysis of the data, project proposals and recommendations: materials for a Science Shop (sketches, drawings, plans, calculations, analysis, feasibility study, project etc.), (if it falls within a specific nature of a Science Shop project); publicity material for a Science Shop project (poster, placard, publication (if such was prepared during the project implementation), audio, video material, etc.); other (according to the nature and need of the Science Shop project).
- To assess the contribution of each student to the Science Shop project at the end of its implementation, and to verify the correlation between functions and responsibilities that were foreseen at the beginning of the project with individual student's contributions at the end of it, students are required to fill in a card for the project team (students) contribution to the Science Shop project.
- After the implementation of a Science Shop project and presentation of the project results to a client, it is recommended that all participants of the Science Shop project (students, lecturers-researchers, the representative of a client) fill in the feedback form. This way problems, strengths, and weaknesses are identified, the experience gained is recognized, and recommendations are formulated.
- For the Science Shop project publicity,

(dissemination of the project and its results), it is recommended to create a publicity plan and inform stakeholders during the project initiation phase: the project activity plan should be flexible enough to involve different target groups and other stakeholders in the project. Well-planned and targeted dissemination ensures that the results of the project benefit not only the direct participants in the project activities but also other stakeholders even after the project is ended. Widespread and high-quality, timely, and well-targeted dissemination of project information not only promotes the individual project but also promotes a Science Shop, reaches those who may find it useful in solving the problem, influences other organisations and contributes to a better image of the project organisation. The publicity (dissemination) plan of the project should foresee what results will be disseminated and why, when, to whom and through what channels, both during and after the project. It is also important to assess the objectives of the publicity plan – they should be related to the project objectives, the methods, and approaches used should be appropriate to the project and its results, the identified target audience, and raise awareness, increase impact, involve stakeholders and target groups, influence policy and practice.

- The choice of dissemination forms of the results of a Science Shop project is determined by the scope of the project, target groups, project content, etc.: publicity can take place at various geographic levels (local, regional, national, European), organisational environment, colleagues, organisations, networks, etc.), clearly identifying target groups.
- It is recommended to use various communication tools that address different target groups to publicize the Science Shop project and its results: placing information on social networks, on the official website of the educational institution or of the Science Shop, in open access systems, creating blogs, posters, leaflets, presentations, promotional stands, issuing publications of various volumes and purposes with project material, to publicize projects at events (conferences, seminars, scientific events and festivals, Career Days, meetings with social partners, etc.), to prepare publications and poster presentations, video and audio reports, virtual exhibitions, etc.

Develop recommendations for defining roles and responsibilities

To plan, implement and monitor a Science Shop project, special temporary organisational structures have to be created (project group, one or more working groups, teams), therefore prior to assigning functions to the members of a student group (team) of a Science Shop it is necessary or even essential to assess how many and what type of groups (teams) are needed or have to be created for a specific project:

- considering the society-relevant problematic issue identified by the students themselves, selected from the problems/ideas bank, or presented by the client, and considering the uniqueness of the research goal, it is recommended to form a project group (team) of 3-5 students.

Considering the nature and specifics of the Science Shop project, student groups (teams) can be composed of 2-3 students, although it is possible that due to the specifics of the project and the uniqueness of the research, only one student works in the Science Shop project. Another possibility is for a Science Shop project team to be comprised of the significantly higher number of students, especially if all groups (teams) address the same problem and students are looking for different solutions to the same problem in a complex Science Shop (e.g. in case a Science Shop project focuses on a complex and complicated problem which requires a lot of different research, several teams of 5-9 students can be composed, it can often be expressed in a large number of students in one Science Shop project – 10 teams of 7-9 students can be involved in one Science Shop project, when 70-90 students are looking for a solution to the problem).

- A Science Shop project group (team) can be formed randomly, when students form a team because they are united by common interests, by a chosen Science Shop topic, by available research competencies or personal connections (e.g., all study assignments are carried out by students within the same team by applying groupwork approach). A Science Shop team (group) can also be formed at random, when the lecturer coordinating a Science Shop project randomly (at his / her discretion or just based on the list of students) divides the students into groups (teams).
- Additionally, a Science Shop project group (team) is recommended to be comprised of students from different study programs and/or courses, or of participants with different skills, abilities and knowledge (for this purpose a Skills and Abilities Card can be used – it is presented in another part of this publication and its annexes). In this way, one team member does not duplicate the competencies of another student with his / her knowledge, abilities and skills, so he/she can later be appointed in charge of the activity or function he / she knows best.
- Games or tasks that help to identify students with leadership qualities are also recommended for the formation of a Science Shop project group (team). They can later take on the role of a team leader in the Science Shop project.

Having identified a problem relevant to the society and formed a group (team) for a Science Shop project, the readiness of the participants is assessed and the functions and responsibilities of each member of the Science Shop project team are foreseen:

- If for some reason the Science Shop project team has already been formed or is being formed in advance, it is recommended that each team member fills in a table of student abilities and skills, indicating which specific Science Shop project area would benefit most from his/her contribution (a sample form (template) is presented in another part of this publication and its annexes). After all the members of the group have completed the table of skills and abilities, it is recommended to discuss the identified abilities and skills together, to group them, to identify the essential and most important skills and abilities that are necessary for a specific Science Shop project (it can be done by preparing cards of skills and abilities and grouping them on a board or poster, forming a table that reflects the abilities and skills identified by the students, making a diagram, etc.). An initial distribution of roles and responsibilities should be carried out, assigning each team member with roles and responsibilities that do not overlap or duplicate the roles and responsibilities of other members of the team, and ensuring that each function is allocated to a student who knows the field best. In addition, students are encouraged to describe their research experience and take a leadership development test to help identify the key attributes needed to ensure proper project implementation. After preparing the project plan, project schedule, other necessary documentation for the Science Shop project, i.e., before the start of a Science Shop project, it is recommended to re-examine the roles and responsibilities of the group, evaluate them one more time and, if necessary, redistribute responsibilities among all members in such a way that it is clear who is in charge for what at the zest of the project.
- If the group (team) has not yet been formed and is not being formed in advance, it is recommended that each team member fills in a table of student abilities and skills, indicating which specific Science Shop pro-

ject area would benefit most from his/her contribution (a sample form (template) is presented in another part of this publication and its annexes). After all the members of the group have completed the table of skills and abilities, it is recommended to discuss the identified abilities and skills together, to group them, to identify the essential and most important skills and abilities that are necessary for a specific Science Shop project. In addition, students are encouraged to describe their research experience and take a leadership development test to help identify the key attributes needed to ensure proper project implementation, as well as to identify several leaders who will bring teams together for a specific Science Shop project. After students have been allocated their teams so that each team has a member with leadership qualities and participants with different skills and abilities, it is recommended to distribute preliminary responsibilities (functions); they will be reviewed and finalized over time after the project plan has been developed.

- It is suggested to describe student roles and responsibilities in as much detail as possible, taking into account the specifics of all activities of the Science Shop project and project-related nuances (e.g., who is responsible for preparing project documentation (plan, report), project valorization, project activities, communication with the client or community, poster layout or invitation of the speaker, research, etc.).
- The roles and responsibilities of lecturers in a Science Shop depend on the specific Science Shop project: lecturers can coordinate the Science Shop, advise students, lead research and participate directly in the project, they can also be experts with experience and advice in a particular field. All Science Shop projects are recommended to have a lecturer coordinating a Science Shop – such a lecturer has research experience and insights on how to coordinate ongoing Science Shop projects, direct them towards the goal and desired results, as well as professional experience, knowledge, and skills in the relevant field. Prior to the inclusion of other lecturers in a Science Shop, it is recommended to set up a system at an institutional level with up-to-date lists of lecturers indicating their competencies, research experience, areas of scientific interest, etc. Such lists allow the Science Shop coordinator to accurately assess lecturers' competencies and invite only those who are most useful in their knowledge, skills, and competencies to a particular Science Shop project to advise students, provide expert insights or conduct specific research.
- The roles and responsibilities of the client (community representatives) in the Science Shop are directly related to the level of their participation in the Science Shop. It can be passive, semi-passive, or active. In the case of the passive client, project participants are only provided with problematic aspects client faces, the solution of which requires research, specified their expectations for the solution of the problem, but the client does not participate in a Science Shop project, does not interfere in its course. For such a client, the research team provides the final conclusions and results and receives feedback on the compliance of the results with the expectations of the client expressed at the beginning of the project. The semi-passive client not only identifies the problematic aspects that need to be researched but also expresses the expectations for solving the problem, participates in the research and/or in one or more activities (s) of the Science Shop project. The semi-passive client together with the students, can participate in data collection, research, or implementation of results, or provide access to their own equipment or infrastructure and conduct research, verify their results in real-time, and so on. During the activities of the project, the semi-passive client can function as a leader, leading and coordinating the activity, or as a group member, together with the students responsible for the desired results. An active client

participates in all project activities, is active in all of them, and in some cases can be a key leader in enabling the use of its infrastructure and conducting research (according to the specifics of the project and the capabilities of the client).

Develop digital teaching tools

Preparation, implementation, publicity, etc. of Science Shop projects can be conducted using a variety of free and open-source applications, digital learning platforms, and tools: virtual learning environment Moodle, capabilities of widely used OneDrive, universal Google and Microsoft (M365) tools, and specialized learning tools such as Formative, Kahoot, Keynote, Quizizz, Quizlet, Socrative and so on. Project publicity events, discussions, meetings with clients, etc. can be organized via video conferencing using ZOOM, MS Teams, etc. Employing a virtual learning environment and various tools and instruments permits such functions as preparation and presentation of learning materials, development of tasks, preparation and presentation of surveys and tests, monitoring of student progress and evaluation, synchronous and asynchronous communication, and more. VLE can also be used to upload sample forms (templates), completed forms, reports, research data summaries, and project publicity material, with all the additional material for the preparation of Science Shop projects. Alternatively, additional tools may be developed within the institution‘s internal network with limited external access. One such solution can be virtual laboratories and other tools used for research, simulation, or obtaining results.

Widely available general sources can be used for publicity of Science Shop projects, registration of a problematic issue, etc.; individual websites can be created or links placed on the institution‘s website. For example, a “Problem Bank” / “Bank of Ideas” can be formed so that it was easily accessible to external clients through the institution’s website along with other study information. Recorded ideas or problematic issues can be widely used to develop Science Shop projects, this way facilitating the work of a project team, saving a lot of time in the project initiation phase, when pilot study and search for potential clients consume a significant part of the team‘s time. In addition, a registered idea or problematic issue is a real case where research is used to solve the problem. Also, the development of a real website using various tools (e.g. WordPress, Wix, Zyro, Mozello, Hostinger) not only serves as a means of finding a problematic aspect or a potential client, but also serves as a precondition for the continuation of a project and ongoing research, and is important for increasing the visibility of Science Shops.

Social networks have been extensively used over the recent years by both individuals and various non-profit organisations or institutions, and therefore, they can serve as yet another tool for finding clients and increasing the visibility of Science Shops. The choice of social networks for communication and publicity depends on the audience that Science Shops address; it can be Facebook, Twitter, YouTube, etc.

Develop templates for applications, CSO contacts, feedback, timelines, etc.

To achieve efficiency and a focus on a separate single part of or of the whole Science Shop, to ensure its integrity and consistency, as well as establish its identity at the institutional level, the Science Shop coordinators are recommended to discuss and prepare templates for each separate task and for every implementation stage of the Science Shop. The model templates applicable to all Science Shop projects at the institution can be used, having made appropriate modifications, working out the details, and elaborating on them.

The use of institutional templates permits the team of a Science Shop (students, lecturers) from the very start of the project to focus on the content of the Science Shop, to start planning it, to concentrate on the problems, as well as in a targeted manner to achieve the results of the project. This way a lot of time is saved since the use of tested solutions prevents wasting time while configuring, selecting the information and the data, systemizing and processing it.

When carrying out Science Shop projects it is recommended to use various ready-made templates for its separate tasks or stages, at the same time assessing the role of each project participant as well as the significance and purpose of the collected information. Therefore it is suggested to prepare general templates applicable (obligatory) to all Science Shops, this way formalizing all Science Shop projects carried out at the institution, as well as specific templates applicable to a particular Science Shop project.

Apart from the general (standard) sample forms that receive little modification, the following templates of forms to be filled in by the participants of the team in each Science Workshop project can be prepared:

- Science Shop Task;
- Description of a Science Shop project;
- Report (with annexes) of the implemented Science Shop;
- Feedback survey of all participants in the Science Shop project.

Recommendations for ***The Science Shop Task***, completed after the initial discussion of the problem among lecturers-researchers, lecturers-consultants, client:

- to indicate the name of the institution (as well as the division that carries out the Science Shop), and present its logo;
- to indicate the title of the Science Shop;
- to clearly and accurately name the participants of the Science Shop project team – students separately, indicating their names, surnames, the title of the study program and course; lecturers-researchers who will lead either the Science Shop project or its separate parts and research, indicating their names and surnames, scientific degree, research areas; lecturers-consultants, who will consult students (and, if necessary, the client) during the different stages of the Science Shop project, indicating their names, scientific degrees, research areas;
- to present the main details of the Science Shop project client, providing accurate data about the type of the client (organisation, community, individual person, etc.), address, representative person (name, surname, position);
- to indicate the foreseen dates of the Science Shop project‘s beginning and end (year, month, day). It is recommended to consider the date of signing the Science Shop Task as the date of its beginning, and the day of submitting results to the client as the date of the Science Shop end;
- to provide a short description of the project: it is recommended to briefly and accurately describe the problem to be solved in the project (up to 300 words), name the specific goal of the Science Shop project, briefly present the Science Workshop project implementation plan (name specific project stages), distinguish the foreseen applied research, provide information about additional human and/or material resources required for the implementation of the project.
- Science Shop Task has to be signed prior to the beginning of the project. The Task is signed between the head of the project group and a client and is submitted to the coordinator of the Science Shop before the start of the project.

The structure and part of the information provided in the ***Description of the Science Shop Project*** can be repeated in the report of the Science Shop if no changes are identified in the stages of project implementation and completion; the description shall include:

- general information about the project: a title of the Science Shop project, project implementation period (start – end), name of the project manager assigned at the beginning of the Science Shop project (name, surname, study program, course) – it is usual to appoint one of the students working in the project; student team (names, surnames, study program, course) and details of lecturers-researchers and consultants (names, surnames, scientific degree, field of research), as well as details of the client (name, name, position).

- description of the initial vision of the project: the problem to be solved during the project, the goal and objectives of the project, the course and the stages of the project, the needs of the client, the results expected by the client, the planned research, etc. It may be submitted together with a project planning scheme or a project schedule, etc.

The description of a Science Shop project is completed after conducting all foreseen research and completing the Science Shop project (in many cases reporting the results of the project to the client). The description of a Science Shop project should contain:

- general information about the project: a title of the Science Shop project, project implementation period (start – end), name of the project manager assigned at the beginning of the Science Shop project (name, surname, study program, course) – it is usual to appoint one of the students working in the project; student team (names, surnames, study program, course) and details of lecturers-researchers and consultants (names, surnames, scientific degree, field of research), as well as details of the client (name, name, position).
- detailed description of the problem solved during the project, the need for the research in light of the conducted analysis of the problem, set aims and achieved results, expectations of the client, etc. (detailed information received from the representative (group of representatives) of a client during the survey or an interview; recommendations by the lecturers-consultants and by the specialists of the field.
- target group(s) of a project, including information about the most benefitting party in the project, as well as about the created greatest benefit;
- justification of Science Shop innovativeness: outstanding, unique features of the project and of its results, aspects of sustainability considered;
- description of scientific research that supported the solution to the problem targeted in the project;
- detailed description of scientific research that was conducted during the project to solve the problem;
- the results of the Science Shop project;
- the report is submitted together with supplementing documents: a templet of the client and experts survey/questionnaire, produced on request, as well as a summary of the obtained data and its analysis; budget for the implementation of the Science Shop (estimate); description of the conducted study and report with the summary of the obtained data and its analysis; project proposals and recommendations: Science Shop materials (sketches, drawings, plans, calculations, analysis, feasibility study, project, etc.), if applicable due to the nature of the Science Shop project; material of the Science Shop publicity (poster, placard, the publication (if these were prepared during the project implementation), audio/video material, etc.); other (depending on the nature and requirement of the Science Shop).

Feedback survey is a document that should be completed by all participants of the Science Shop (students, lecturers-researchers, a representative of the client). It is carried out having conducted all research, having implemented the Science Shop project, and having submitted the results of the project to the client.

- Apart from the standard information (title, date of implementation, client), students are asked to evaluate the Science Shop in their feedback survey. They are asked to identify the most positive aspects of the project and of its different stages, as well as aspects to be improved; students should also describe their new experience, its applicability in the future, gained competencies, and provide suggestions and recommendations.
- Apart from the standard information in the lecturer/researcher feedback survey (title, date of implementation, client), they are asked to indicate the stage(s) of the Science Shop that they participated in, identify

the benefits and drawbacks of the Science Shop, provide suggestions and recommendations regarding organisation and implementation of the Science Shop, required research, recommendations for the students.
- Apart from the standard information in the client feedback survey (title, date of implementation, client), clients are asked to indicate the stage(s) of the Science Shop they participated in, identify the problem the Science Shop project and research within it focused on; describe initial expectations as well as the results at the end of the Science Shop project implementation; clients are also asked to identify benefits and drawbacks of the Science Shop, provide suggestions and recommendations regarding organisation and implementation of the Science Shop, required research, recommendations for the students.

It is also recommended to use standard forms (templets) developed for different stages and tasks of a Science Shop:

- A card for skills and abilities of a Science Shop team (students);
- A Problem-Solving Parties Identification Card and a scheme of real problem-solving parties;
- A table of prospective clients for Science Shops;
- A card for the stakeholder (public interest) in solving the problem;
- A card for planning client impact;
- A planning card for the Science Shop;
- A timetable of the Science Shop;
- A card for risk evaluation;
- A card for the team (students) contribution to the Science Shop project, etc.

The Skills and Abilities Card for the Science Shop project team (students) is used in the initial stages of the project to form student teams and to allocate the roles and responsibilities of the team members. It is possible to first present an individual card to each student separately, and then, after analyzing the data obtained, divide the students into teams so that one team member complements another; this helps the team members allocate their responsibilities and functions in the way that best reflects their skills and abilities. Alternatively, if students are already divided into teams or have selected team members, both an individual and a team student skills and abilities card can be provided: after completing and summarizing the data obtained, the students with the most skills and abilities in certain areas are selected; in case some students competences overlap, the responsibilities are redistributed proportionally to each team member so that all team members have their own field of activity and there are no activities for which no team member or project manager is responsible.

In the Skills and Abilities Card of the Science Shop project team (students), students are asked to identify their abilities and skills that could be useful in the Science Shop project. After planning the project, these cards are reviewed again and the real possibilities, functions, and responsibilities of each team member are reassessed. The roles and responsibilities of the team members are identified in the Science Shop project planning schedule. If required, a separate card may be issued to document functions and responsibilities.

A Problem-Solving Party Identification Card is prepared by conducting a pilot study having no specific client or no refined (selected) aspect of the problem. In such a case, several cards can be filled in for each problematic aspect, when searching for the most relevant aspect and solving the issue of finding a potential client. This problem-solving party identification card identifies the problematic aspect and briefly describes the problem, making a list of possible problem-solving parties (in all aspects). After a comparative analysis of the completed cards and selection of a specific aspect, several (up to 2 to 4) real problem-solving parties are selected and a structured scheme is developed, identifying the problem-solving methods and possibilities and the planning surveys and methodology for each problem-solving party. After detailing the possibilities of each party, one real solution to the problem is selected and potential clients-partners are sought.

Compilations or registers of non-governmental organisations, various databases, etc. can be used to search for a potential client. ***A Table of Prospective Clients-Partners of the Science Shop*** is filled in. It indicates the name of the potential client, legal form, main data (address, contact information), and field of activity. Each potential client is described according to the following criteria: problems faced by the potential client partner; the need for research, expectations; a potential client's experience of cooperation with higher education institutions in conducting joint research; the expected benefits of the research results for the potential client; opportunities for the potential client to get involved in the project and participate in its activities; requirements for the project team; the desired duration of the Science Shop project and the deadline for submission of results.

The Stakeholder and Public Interest Card is completed by selecting one (or more) Science Shop project partner (s) to assess the demand for research, aspects of research activities, potential impact and participation in research, evaluating benefits of the expected impact, and results of the research. In the case of several potential clients, a later analysis is performed to select a client whose expectations can be best met by the assembled project team (in light of the available competencies, ability to perform certain research, etc.).

A Card for Planning Client Impact is used when having selected one specific Science Shop project partner. It identifies the purpose of the impact, possible reasons for the client's interest in the Science Shop project and areas promoting involvement in the Science Shop project and research, client's experience in joint research. Possible risks of impact are also described, and the need for resources and the deadline for the completion of the project desired by the client are identified.

A Card for Science Shop Project Planning provides general information such as the title of the Science Shop project, the duration of the project, its purpose, objectives, activities/actions, participants, budget (need for funds), duration, and scope of implementation of each project phase. Along with this card, the schedule of the Science Shop project and the risk evaluation card can be filled in.

The Timetable of the Science Shop Project is developed by assembling teams of students, refining the problematic aspect, having a client, and completing the initial planning steps of the Science Shop project. The schedule of the Science Shop project is made for all stages of the project implementation from its initiation to completion and public promotion. Individual activities, the total duration of the project in weeks as well as the duration of each phase are foreseen here too. It is recommended that the schedule be logical and consistent, but it is also estimated that activities in a given phase must take place during all the weeks covered by the schedule (there must be no weeks when no project activity takes place). The schedule can be drawn up only for the weeks when the project is actually being carried out, student holiday periods can be marked but not included in the duration of the project. It is recommended to indicate the weeks of the project, no matter which month or day the Science Shop project starts. If necessary, the schedule may change the calculation of the project duration by specifying specific calendar weeks, correlating with the start and end dates of the project in the Science Shop task and in the various completed cards. Also, for each stage and activity, the member of the team responsible for the implementation of its activities is indicated.

The Risk Assessment Card assesses the risk at each stage in terms of levels, provides a level of risk, a detailed description of the risk, and foresees measures to reduce the risk. At each stage of the Science Shop project, it is recommended to describe the risks according to several different parameters, the number and choice of which depend on the specifics and features of the project (e.g. people, time, scope, finances).

The Science Shop Project Team (Student) Contribution Card is completed at the end of the project to assess each student's contribution to the project and to check how the roles and responsibilities foreseen in the project planning phase correlate with the student's contribution after the project implementation. The card is completed by each student individually. This type of card can also be presented to the project team leader and lecturers, who have worked with students at all stages and are able to evaluate their results, to assess the students' contribution.

V. SKILLS DEVELOPMENT AND EVALUATION

Identify assessment opportunities, evaluate boundaries.

Development and evaluation of skills: methods in light of evaluation/assessment possibilities

Skill development and evaluation are among the most important components of the study. Every lecturer should be concerned about how much students have learned and if they haven't learned, why not. If students come to lectures motivated for hard work, it is the responsibility of the lecturer to help them. If there is no motivation, it is a job of a lecturer to inspire. Contemporary young people do not always dare to speak out, express their wishes, compete in authoritative professions, and do not always feel they are an important part of the learning system. Therefore, the semi-structured (semi-standardized) interview was selected for qualitative research, where the interview procedure and questions are only partially standardized, with only a few prearranged questions; it helped to conduct unstructured interviews and create a better rapport between the interviewer and the respondent. During the interview, the researchers followed the guidelines of the interview, allowing the interview to develop organically: during each interview, the sequence of questions largely depended on the course of the interview and the respondent's opinion, although a rare respondent purposely sought to direct the interview to a less formalized pattern, and additional questions were asked only when needed to elaborate or supplement the provided answers.

The interview involved 25 students from different study programs who took part in Science Shop projects. During this study, the majority of students surveyed claimed that Science Shop projects have improved skills such as research, social, creativity, independence, innovation receptiveness, ability to communicate and collaborate, ability to assess and evaluate, technological skills, and a new approach to collaborative learning. Respondents spoke about teaching methods used by lecturers, pointing out that traditional lectures are not sufficient for students to improve their skills. Students also insisted that discussions, seminars, as well as practical and individual activities are best suited to the lectures in the Science Shop project format. Students commented on teaching methods such as “Add me (to real activities, real examples, processes) -- and I will understand” (I will learn, I will start doing a lot of things on my own, to act) and “Let me (give me a mandate, a freedom of activity, a space for autonomy) -- and I will succeed” that have improved their skills best. 50% of respondents answered the question of what previous skills had been improved as part of the Science Shop projects: being able to communicate and collaborate, being able to assess and evaluate. Research and social skills have also been mentioned as new skills developed during the Science Shop projects. The students surveyed argue unequivocally that the skills acquired meet the needs of the market and the often-mentioned expectations of the social partners/employers about the competence of the employee and the skills required.

During the interview, respondents mentioned that Science Shop projects could be evaluated considering such aspects as the multidimensionality and scope of results, further use of project results, innovation, and project continuity. Also, 100% of respondents emphasized that the methods used were appropriate for evaluation and self-evaluation of students’ progress and change in skills development and improvement.

DEVELOP GUIDELINES FOR EVALUATION STRATEGIES

1. Purpose of the evaluation
2. Grouping project implementation teams
3. Evaluation methods
4. Self evaluation
5. Group members‘ evaluation
6. External evaluation
7. Final evaluation
8. Student feedback

1. PURPOSE OF THE EVALUATION

- Purpose of the evaluation – to help students learn.
- This can be achieved by engaging students in the activities of peer evaluation and self-evaluation. Students provide feedback to others and to themselves when assessing and evaluating their performance and results. When learning to evaluate their own work and the work of others while applying the provided criteria, students develop an awareness of the requirements for good work or proper performance, learn to see the strengths and areas of improvement of their activities and those of others and to envisage ways of improvement.
- Evaluation is one more key aspect of the Science Shop projects, where the participation of students in the evaluation process, reflection on learning, self-evaluation, and feedback on the achievements of other students is essential.

Theoretical justification

Students’ participation in project activities has a significant impact on their internal motivation. Motivation is especially encouraged when students themselves choose a topic and formulate a problem. Being able to work independently and perform specific roles also strengthens learning motivation. However, project activities require compliance with certain obligations which may change at different stages of operations. Prior to presenting the Science Shop results, it is recommended to conduct interim discussions of the results and summarize the project. The evaluation strategy of a Science Shop consists of several stages. During the project evaluation stage, feedback is provided to other project participants. In light of the set criteria, contribution to the success of the project is reflected and assessed. According to the research (Tylienė, 2021), the most important components of Science Shop competencies for both students and “clients- partners” are teamwork, planning, and organisational skills, strategy development skills, the ability to communicate, collaborate and act in real circumstances, the ability to identify, select and make proper use of the necessary information through data, Science Shop databases and other sources of information. Taking all these aspects into consideration, the self-evaluation of teamwork, the ability to plan the progress of the project, and the evaluation of strategy development skills play an important role in the evaluation of a Science Shop project.

The purpose of the evaluation is to evaluate the results achieved by the students during the Science Shop project, and their level and to provide the students with feedback on their achievements and progress. Learning outcomes are clearly defined statements of what a student should know and/or be able to demonstrate at the end of a Science Shop project. Evaluation of the achievement is developed and considered by the College as a platform for all study participants to discuss and agree on the issues of learning to learn and learning improvement. Evaluation is understood as an integral student learning experience that enhances student learning, provides information about progress, and nurtures personality potential. The evaluation of achievements should go beyond the evaluation process and link many components:

- the main principles of performance appraisal;
- organisation and ethics of evaluation;
- policy of academic integrity;
- functions, involvement, responsibilities, rights, and duties of lecturers and students;
- study results of the program as an initial element of program construction;
- tasks and elements of feedback such as constantly experienced and experienced learning situations, etc.

At the beginning of the semester, a lecturer informs students about the evaluation of Science Shop project learning outcomes. The lecturer presents a detailed subject program, objectives, expected learning outcomes, and specific structure of evaluation of the study subject results (the impact of interim evaluations on the final grade, cases that will require revision of the course/of the final assignment), evaluation criteria and requirements. Students are introduced to the evaluation system of the subject, study results of the program, links between the study program's results and the subject results, as well as the methods of evaluation of students‘ achievements (Table 4).

Table 4

Links between study program's results and study subjects' results and evaluation methods of study students' achievement results

Learning out- study program	the course studies	Study methods	evaluation methods
Will understand ethical, environmental, and commercial aspects of engineering activities.	Will be able to plan, organize, carry out and evaluate practical activities in specific areas of the professional domain, independently choosing technological, organisational, and methodological tools.	Lectures, practical tasks, independent work, discussions, work in groups, individual consultations.	Evaluation of practical work.
and environmental impact of engineering solutions and will follow the standards of professional ethics and engineering activities.	Will be able to independently deepen their knowledge in professional activities, will understand their responsibility from an eth- ronmental point of view.	Case studies, exercises, discussions and debates, presentations of inde- review.	Problem issues, tests, yes/no questions, problem tasks. Presentation of practical task results. Individual presentation
	Ability to consistently, reasonably, in the correct language, and orderly present the principal decisions of Science Shop, both in writing and orally, in accordance with the established requirements, in compliance with academic ethics.	Exercises, preparation, and presentation of individual tasks, discussions and debates, literature review.	Public presentation of the practical work results. Individual presentation.

2. GROUPING PROJECT IMPLEMENTATION TEAMS

- Science Shop projects are a group activity.
- They are aimed at analyzing a variety of practical problems through empirical research and at searching for solutions to the issues addressed.
- During the project, students work in teams of 2-5 people. Students can set the teams themselves.
- In this way, students choose the people they can trust to take responsibility for the best outcome. This develops students�cooperation, tolerance, and communication with specialists when seeking solutions to professional questions.
- The student group is advised by a lecturer who helps students discover the answers to their questions and assesses the work of the group. One semester is allocated to the implementation of the project.

Theoretical justification

Students are quite positive about the benefits of group work and the skills they develop (Adnan et al., 2019), but a significant proportion would still choose personal accountability, i.e., they would like their score to depend solely on their own abilities and efforts (Davies, 2009). This is usually due to the fact that lecturers often give all members of the group an overall evaluation, regardless of the contribution of different value and quality to the final result or evaluation, which adds stress and anxiety to students because the group is not always functional, conflict-free and so on. (Maiden & Perry, 2010). A group task is certainly the most appropriate tool to achieve the results of a Science Shop project, but the lecturer has to decide what size group to form. Once it has been decided that students will be assigned a group task, the role of the lecturer becomes particularly important – it is necessary to decide what the composition and size of the group should be.

Recommendation. When deciding whether to allow students to form a team or distribute them by the lecturer, what criteria to apply for team development, etc., it is suggested to take into account the students‘ dynamics (if there has already been some interaction) and the task (Kapočiutė, 2020). Students frequently form teams according to the following criteria:

- Friendship. Only those students who are already friends tend to put themselves into teams;
- Study results. Students take study results into account and want to group only with students whose results are really good;
- Attendance. When developing teams, students tend to team up with those groupmates who have no discipline issues;
- Prospects. When a student does not see any prospects for working in a team, he/she chooses to conduct individual Science Shop task.

The next step is to properly design the tasks and choose the evaluation method and criteria. One of the conditions for a qualitatively completed task is that students have clearly formulated purpose of their group, tasks, deadlines for their completion, evaluation criteria, etc., that is, students need to have a clear understanding of what is expected of them. Also, no less important condition for successful group work is the management of the group task performance process, i. y. monitoring the group work process.

Recommendation. Monitor the progress of teamwork and apply timely measures to prevent excessive actions, deviations from the goal, etc. Allocate time for meetings and consultations (Kapočiutė, 2020). Therefore, clear requirements and well-defined form for the team task and for its evaluation permit only minimal lecturer assistance to satisfy the needs of team members. It is recommended that each team select a lecturer-consultant who advises the group throughout the project according to the specifics of the subject.

3. EVALUATION METHODS

- Project evaluation consists of internal and external evaluations.
- Evaluation factors: internal evaluation: 50% and external evaluation: 50%.
- Internal evaluation comprises 50%, where 10% is self-evaluation and 40% is the evaluation by project group members.
- External evaluation is carried out by the project leader and a Board comprised of the representatives of social partners. External evaluation: 50%, where 30% evaluation by the supervisor, 20% evaluation by the Board.

Theoretical justification

A Science Shop subject at Vilnius College of Technologies and Design is assessed by applying a cumulative, formative, diagnostic and collegial evaluation system. In order to ensure active student participation throughout the study semester, to encourage the application of theoretical knowledge in practice, to seek objectivity in the evaluation of study results, and to avoid cases of plagiarism, the VTDK applies ***cumulative evaluation***, i.e., study results are assessed by interim evaluations. Different parts of cumulative evaluation address different learning outcomes.

Formative evaluation: the lecturer organizes the lecture, observes, comments, encourages students to evaluate and self-evaluate their learning, students are also explained how evaluation helps to learn, how important feedback is, what are the roles of a student, a lecturer, and a partner in the Science Shop process. The lecturer also collaborates with students, explains achievement requirements, criteria, and indicators, discusses gaps in some stages of the project, provides examples of how tasks can be performed well, and notices and acknowledges various student achievements and their progress. Formative evaluation is informal, not linked to a grade. The student‘s activity is evaluated by an oral comment, reflecting on each lecture, supplementing and correcting the answers and the work done. Written comments are provided when there is such a need, identifying successes and failures, and possibilities for improvement.

Diagnostic evaluation: while applying diagnostic evaluation, the lecturer defines students‘ study goals, objectives, and expected results in a clear and accessible manner, teaches students to compare what they have learned with what was intended for them to learn, explains to them how to correct failures and fill learning gaps, chooses an appropriate form, scope, time for providing feedback, explains and discusses the results of the student Science Shop project, points out that different evaluation methods are used for different evaluation purposes. Diagnostic evaluation is based on daily observation of students, the results of independent, creative, practical work during individual stages of the project. Diagnostic evaluation is formal, assessed by a grade (10-point system, according to the ICI index) at the end of a certain stage of the project.

4. SELF-EVALUATION

- Selection of evaluation criteria is a very important element in project implementation.
- The criteria must clearly reflect the objectives of the teaching/learning and guide the student and achieve these objectives.
- Students should be able to appreciate their achievements and development as part of the Science Shop project.
- The evaluation may be subject to the same criteria as the evaluation of the members of the group.

Table 5

Self-evaluation

	Criteria	Evaluation score (1-10)	Evaluation comment
1.	Responsibility		
2.	Organisation		
3.	Ideas and suggestions		
4.	Data collection		
5.	Data analysis		
6.	Writing project report		
	TOTAL SCORE		

The average evaluation score is calculated.

5. GROUP MEMBERS‘ EVALUATION

- An important issue with group evaluation is to weigh the contribution of each member of the group.
- The best way to do this is for the members of the group themselves.
- They can do this by filling out the evaluation sheets of the other members of the group, taking into account the established evaluation criteria.
- The following criteria for evaluating participation in the work of the group are proposed.

Table 6

Group members‘ evaluation

Criteria	Evaluation score (1-10)	Evaluation comment
1. Responsibility		
2. Organisation		
3. Ideas and suggestions		
4. Data collection		
5. Data analysis		
6. Writing project report		
TOTAL SCORE		

The average evaluation score is calculated.

6. EXTERNAL EVALUATION

Table 7

Criteria		Evaluation score (1-10)
1.	Relevance and development of the topic solution	
2.	Scope of work, quality of conduct (applied artistic and visual means)	
3.	Completeness and applicability of the work	
4.	Cooperation, community engagement, impact on the community	
5.	Presentation conciseness, informativeness, accuracy	
6.	Language of the presentation delivery	
7.	Ability to answer questions	
8.	Ability to engage and to retain attention	
	TOTAL SCORE	

The average evaluation score is calculated.

7. FINAL EVALUATION

After evaluation of the project, the average score of the evaluation shall be calculated, which constitutes the final evaluation of the student and the level of achievement which may be excellent, typical, threshold.

Table 8

Final assessment of students by level of achievement

Level of achievement	Criterion of evaluation
Excellent **(10 /9)**	• a student demonstrates active participation and initiative; • a student can make independent decisions; • a student demonstrates good teamwork skills; has a strong motivated opinion, is able to have constructive discussions with others; • a student demonstrates good knowledge, skills and abilities, • a student operates in a diligent, responsible, targeted manner; • a student is able to critically assess his actions and can make suggestions for further development.
Typical **(8 / 7)**	• a student demonstrates effective participation and a proactive approach; • a student is able to follow rules and orders; • a student demonstrates teamwork abilities; • a student operates in a thorough manner (there are minor deviations and mistakes); • a student is able to objectively assess his/her work.
Thershold **(6 / 5)**	• a student seeks to act, proactive; • a student needs guidance; • a student does not know how to work well with other students; • there are obvious errors, inaccuracies in a student‘s work; • a student‘s initiative is practically not monitored; • a student is not particularly critical of his actions.

Theoretical justification

The evaluation system for the subject of Science Shop project is published on the Internet, for example, in the MS Teams members of each team can see the individual / team evaluation of each project activity stage on-line (Table 9). Due to the protection of personal data, an individual channel for each team is created on the MS Teams platform, where the lecturer publishes the evaluation results, comments and feedback on various evaluation stages.

Table 9

An example for evaluation of Science Shop project subject

Nr.	Project title	Client	Group	Students/ Student teams	Task Card 20% 2020 11 20 110 % – search for potential partners 10 % – identification of problem, Its development into Science Shop focus	Poster/ Tablet 30% 2020 12 11	Presentation of the project 50% 2020 12 31 Participation in a scientific conference 20 % – evaluation by the lecturer 20 % – evaluation by a partner 10 % – self-evaluation by the team	Final mark 100%
1.	optimization of a heating system	Vilnius Lazdynai school		Student 1	20%	30%	50%	100
				Student 2	20%	30%	50%	100
				Student 3	20%	30%	50%	100
				Student 4	20%	30%	50%	100
				Student 5	10%	30%	30%	70
2	Investigation of anti-corrosion properties of epoxy, acidic and simple anti-corrosion primers and paints 3in1	MB “Technoresta”	MT19D	Student 1	20%	30%	50%	100
				Student 2	20%	30%	50%	100
				Student 3	20%	30%	50%	100
	Installation of Vilnius street lamps			Student 4	20%	30%	50%	100
				Student 3	20 %	30%	50%	100
				Student 4	20 %	30%	50%	100
4	Fleet maintenance optimization	Automobilininkų asociacija “Auto“	AT19D	Student 1	20 %	30%	50%	100
				Student 2	20 %	30%	50%	100
				Student 3	20 %	30%	50%	100
5	Optimization of operation a car wash	MB “ŠVARUČIAI”	AT29D	Student 1	20 %	30%	40%	90
				Student 2	20 %	30%	40%	90
				Student 3	10 %	30%	40%	80
				Student 4	20 %	30%	40%	90
				Student 5	10 %	30%	40%	80
6	Business process development at UAB “Abrosa“	UAB ”Abrosa”	AT19D	Student 1	20 %	30%	50%	100
				Student 2	20 %	30%	50%	100
7	Plan for tyre fitting activity optimization	UAB “Aljuva”	AT19D	Studentas 1	10 %	30%	40%	80
				Studentas 2	10 %	30%	40%	80
				Studentas 3	20 %	30%	40%	90

Theoretical justification

The evaluation system for the subject of the Science Shop project is published on the Internet, for example, in the MS Teams members of each team can see the individual/team evaluation of each project activity stage online (Table 2). Due to the protection of personal data, an individual channel for each team is created on the MS Teams platform, where the lecturer publishes the evaluation results, comments, and feedback on various evaluation stages.

The presentation of the project is a diagnostic/collegiate evaluation of the Science Shop project. There are several presentation models available to students:

- Participation in international/national students' scientific-practical conferences, during which visual presentations of Science Shops with the use of interactive IT technologies and programs are organized. Vilnius College of Technology and Design traditionally organizes republican conferences during the year, e.g. "Technological Innovations", "Technological and Management Innovations", "Sciences – the Basis of a Qualified Engineer", "Environmental Protection and Engineering", where students have the opportunity to present the results of completed Science Shop projects.
- Writing and publishing scientific articles in periodicals, such as Technology and Arts, Role of Higher Education in Society: Challenges, Tendencies and Perspectives.
- Vilnius College of Technology and Design organizes an official presentation of a Science Shop project, which is open to all interested students, lecturers, lecturers-consultants, as well as invited partners, i.e. representatives of organisations, and associations, NGOs, municipalities that have been participating in the Science Shop project. In such a case, the collegial evaluation method (peer review) is applied. Peer review is used to ensure the objectivity of evaluation, prepare students for integration into science, and create opportunities to develop communication skills. During the peer review, students are examined by a commission of the Science Shop project manager, lecturers – consultants, and a partner. Peer evaluation is applicable to test and assess a student's special abilities when organizing reviews of students' work. A review is a public display of student work (posters/tablets) or a presentation of work. Then the coefficient of 0.5 is distributed as follows: 0.2 – evaluation of the Science Shop project manager, 0.2 – evaluation of the partner's representative, 0.1 – group self-evaluation.
- Students are invited to client organisations, companies, and centers, where the presentation, evaluation, and discussions of the results of the student Science Shops are organized. In that case, the peer evaluation method is also applied.

STUDENT FEEDBACK

- Once students have been evaluated, it's very important to get feedback, to check if students have understood what they should have done and how they should have done it.
- Find out what was most difficult, uninteresting, unhelpful, and what helped them to recognize the strengths and weaknesses of their work, to identify ways of improving what motivated and encouraged them to be more successful.
- After presenting the project for external evaluation students are asked to fill out the feedback questionnaire anonymously.
- The purpose of the questionnaires is to find out students' opinion on the Science Shop project and the quality of its organisation.
- Appropriate feedback is considered one of the most effective teaching and learning methods.

Table 10
Feedback questionnaire

Date____________________

Team title	
Have you developed competences that could benefit you in the future. If so, what?	
3 aspects that you liked most about the participating in a Science Shop	1. 2. 3.
3 aspects that you liked least about the participating in a Science Shop	1. 2. 3.

Theoretical justification

VThe lecturers of Vilnius College of Technology and Design have accumulated lot of experience in teaching the subject of the Science Shop project, therefore they can identify the strengths of each stage of the activity and the aspects to be improved. For example, the weakness of the "finding potential partners" phase is that students face significant challenges and problems finding project partners. To search for potential partners, students use an NGO catalog, an NGO[2] atlas, or personal contacts. Organisations, associations, centers do not actively liaise and cooperate with students, and often there is little time left for the students to conduct the research itself. Therefore, when organizing a Science Shop project, the timeframe should be set for finding potential partners, and it is also suggested that each student establish at least two collaborative relationships, thus creating a "bank of ideas" for potential partners. Various organisations, municipality representatives, and members of associations can present the ideas or problems for the Science Shop project in the electronic space3, this way creating "bank of ideas", where students can choose a suitable focus for their project, thus saving time in finding partners. Based on the experience of Vilnius College of Technology and Design and the previous strategy of implementing Science Shop projects, it can be stated that potential partners use the "bank of ideas" minimally, therefore many students choose the methods described above for finding organisations. Hence, it is recommended to plan the course of the Science Shop project, where the schedule of each stage of the project would be reflected (Table 11). Table 11 presents a plan for the interim evaluation during the Science Shop project in the autumn semester of 2020. The plan permits students flexibility while individually completing the planned stages of the project. The different stages of the student project were presented in the MS Teams files according to a schedule, which allowed the lecturer to systematically manage and objectively evaluate the process.

Table 11
Science Shop project plan 2020

Potencialių partnerių paieška	Problemos identifikavimas/ Užduoties kortelės pildymas	Problemos transformavimas į tyrimą	Rezultatų apdorojimas	Mokslo dirbtuvių pristatymo rengimas	Posterio rengima s
Iki 2020 09 30	Iki 2020 10 15	Iki 2020 11 30	Iki 2020 12 15	Iki 2021 01 15	Iki 2021 01 30

2. Accessed via the Internet: https://nvoatlasas.lt/

3. Accessed via the Internet: https://mokslodirbtuves.vtdko.lt/

More attention has to be focused on individual self-evaluation in the group. There are three ways to evaluate the result of group work individually: self-evaluation, evaluation of group members and evaluation of the lecturer. Self-evaluation means that each student evaluates their own contribution, which can be compared with the evaluations of other members of the group, and the final evaluation is decided by the lecturer. For self-evaluation, a student evaluates his / her contribution to group work by completing a questionnaire or in a free form. Proponents of self-evaluation as a component of final evaluation believe that students must learn to objectively evaluate their contribution, achievement, actions, and so on. (Delaney et al., 2013). Also, the results of the self-evaluation can indicate how much the student has immersed into and understood the task. In addition, self-control is a kind of counterweight to the self-evaluation a specific student. A student evaluates the contribution of his / her group members by completing a questionnaire or in a free form. Proponents of this evaluation believe that students find it easier to observe how work is done within a group, to evaluate the individual efforts of group members, and to contribute to the overall outcome (Delaney et al., 2013).

The following benefits of evaluating group members have been identified:

1) it permits a fairer evaluation of the group work, as the contribution of group members is clearly known to students;

2) it promotes students‘ independence and allows them to develop their personal and interpersonal skills;

3) prior knowledge of the evaluation procedure means a better understanding of what is considered to be high quality work;

4) knowledge that individual work will be evaluated by the members of the group encourages the student to put in more effort;

5) it allows to reduce time a lecturer spends to objectively evaluate group work, i.e., instead of devoting time to monitor individual group members‘ activities, a lecturer may use to providing feedback.

Table 12 provides an example of individual groupwork self-evaluation and feedback by a lecturer teaching a Science Shop project. Feedback can also be part of an informal evaluation, e.g., a lecturer and team members can discuss collaboration problems or other aspects of the interpersonal relationship that are not essentially the result of the task and may not be reflected in the evaluation. It is also important to establish the significance of ensuring the anonymity of group members‘ evaluation. It is considered that ensuring anonymity is not necessary when providing an evaluation of group members. Therefore, this example shows that the comments column does not show who comments and evaluates the group members‘ contribution to the overall project.

Table 12

Individual self-evaluation of students in a group of a Science Shop project

Nr.	Project title	Participants	Self-evaluation, 50%	Group member evaluation, 50%				Comments
1.	Automation and optimization of a heating system in premises	Student 1	50%	50%	50%	50%	50%	Worked well, created a poster
		Student 2	50%	50%	50%	50%	50%	Successfully presented the project at a conference.
		Student 3	10%	10%	10%	5%	5%	Poor attendance
		Student 4	50%	50%	50%	50%	50%	Processed the results of the research
		Student 5	5%	5%	10%	10%	0%	Disappeared

Recommendations for the development of Science Shop project evaluation strategies

1. Cooperation between a student and a lecturer.

The higher education institution should encourage and support student-lecturer cooperation, as it engages in the learning process, as well as develops and sustains new and continuing learning experiences. A culture of cooperation requires preparation and involvement on both sides.

- A student is acquainted with the aims of the Science Shop, with the planned results of the subject, mutual expectations and requirements are discussed;
- a lecturer prepares and provides tasks that help the student to consistently develop skills and discuss learning progress;
- a lecturer teaches students to properly plan the course of the Science Shop project, helps to find potential partners, and identify problems that will transform into research work;
- a lecturer formulates the evaluation criteria, that create the basis for the description of the student‘s progress and effort, execution of the task, completeness, achievement of the result;
- a student is able to monitor and compare the planned intended results of the subject with the acquired knowledge, abilities, and changing attitudes;
- students are taught and encouraged to recognize which planned subject outcomes they have already achieved and can provide evidence if the practice of recognizing prior learning is required;
- students are taught to monitor their progress and are acquainted with various ways of self-evaluation.

2. Planning the achievement evaluation process

The higher education institution should aim to develop and ensure a transparent evaluation process, and accurate and clear procedures. Clear articulation of subject results, requirements, appropriate tasks, standards, and criteria, as well as their communication to all stakeholders, ensures the transparency and reliability of the decisions.

3. (Self-) Involvement of students.

A higher education institution should enable students to be involved in the development of the evaluation guidelines. Students should also take responsibility for actively engaging in the evaluation process. Students should be actively involved in the day-to-day study matters and the evaluation process by collaborating, expressing opinions, making suggestions and thus stimulating a change in the culture of evaluation. Higher education should demonstrate responsibility and enable students to properly participate in the evaluation process and discussions about learning improvement, as students enter higher education with different learning experiences, abilities, and different understanding of higher education (Education Exchange Support Foundation, 2018).

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Annex 1: Links to reports from different countries. (European Commission, 2017):

Austrija – https://ec.europa.eu/futurium/en/system/files/ged/at_country_analysis.pdf

Belgija – https://ec.europa.eu/futurium/en/system/files/ged/be_country_analysis.pdf

Čekija – https://ec.europa.eu/futurium/en/system/files/ged/cz_country_analysis.pdf

Vokietija – https://ec.europa.eu/futurium/en/system/files/ged/de_country_analysis.pdf

Danija – https://ec.europa.eu/futurium/en/system/files/ged/dk_country_analysis.pdf

Ispanija – https://ec.europa.eu/futurium/en/system/files/ged/es_country_analysis.pdf

Prancūzija – https://ec.europa.eu/futurium/en/system/files/ged/fr_country_analysis.pdf

Vengrija – https://ec.europa.eu/futurium/en/system/files/ged/hu_country_analysis.pdf

Italija – https://ec.europa.eu/futurium/en/system/files/ged/it_country_analysis.pdf

Lietuva – https://ec.europa.eu/futurium/en/system/files/ged/lt_country_analysis.pdf

Liuksemburgas – https://ec.europa.eu/futurium/en/system/files/ged/lu_country_analysis.pdf

Nyderlandai – https://ec.europa.eu/futurium/en/system/files/ged/nl_country_analysis.pdf

Lenkija – https://ec.europa.eu/futurium/en/system/files/ged/pl_country_analysis.pdf

Portugalija – https://ec.europa.eu/futurium/en/system/files/ged/pt_country_analysis.pdf

Švedija – https://ec.europa.eu/futurium/en/system/files/ged/se_country_analysis.pdf

	Name of the educational institution Logo

SCIENCE SHOP FEEDBACK QUESTIONNAIRE FOR LECTURERS-RESEARCHERS

Title of the science shop project	
Implementation period of the science shop project (start – finish)	MMMM-XX-DD – MMMM-XX-DD
Client *(name, address, a representing person (name, surname, responsibilities)*	

Indicate those stages of the science shop project which you participated in	• ***project initiation*** • ***project planning*** • ***project implementation*** • ***project monitoring*** • ***project completion and publicity***

Identify the ADVANTAGES of the science shop project:
Identify the DISADVANTAGES of the science shop project:
Recommendations and suggestions about organization and impementation of the science shop project:
Recommendations and suggestions for the student team:
Recommendations and suggestions regarding application of science shop‘s results:

Name of the educational institution
Logo

SCIENCE SHOP QUESTIONNAIRE FOR STUDENTS' FEEDBACK

A title of the science shop	
Implementation period of the science shop (start – finish)	MMMM-XX-DD – MMMM-XX-DD
Client *(name, address, a representing person (name, surname, responsibilities)*	

Did you enjoy working in the science shop project?	• I did, very much; • I did; • I rather liked it; • I did not like it; • I have no opinion.
Identify the aspect of the science shop project you LIKED MOST. Why?	
What were you most SUCCESSFUL at during each stage of the science shop?	
Initiation *stage of the science shop project*:	
Planning *stage of the science shop project*:	
Implementation *stage of the science shop project*:	
Completion and publicity *stage of the science shop project* :	
Identify the aspect of the science shop project you DID NOT LIKE AT ALL. Why?	

What did you find difficult during each stage of the science shop?	
Initiation *stage of the science shop*:	
Planning *stage of the science shop*:	
Implementation *stage of the science shop*:	
Completion and publicity *stage of the science shop*:	
What new experience did you gain while working on a science shop project?	
In your opinion, what competencies did you develop while participating in the science shop?	
In your opinion, how could the new competences be used in your professional activities?	
Suggestions and remarks for the organization of science shop projects:	

Name of the educational institution Logo

SCIENCE SHOP QUESTIONNAIRE FOR THE CLIENTS‘ FEEDBACK

A title of the science shop project	
Implementation period of the science shop project (start – finish)	MMMM-XX-DD – MMMM-XX-DD
Client *(name, address, a representing person (name, surname, responsibilities)*	

Indicate those stages of the science shop project which you participated in	• ***project initiation*** • ***project planning*** • ***project implementation*** • ***project monitoring*** • ***project completion and publicity***
Identify the problem, the solution to which required a research-based science shop project	
Describe your expectations at the beginning of the science shop project	
Provide your detailed comments regarding the obtained results and conducted research during the science shop project	

Identify the ADVANTAGES of the science shop project:
Identify the DISADVANTAGES of the science shop project:
Recommendations and suggestions regarding the organization and execution of science shops:
Recommendations and suggestions for the student team:
Recommendations and suggestions regarding application of science shop‘s research and results to solving real-life problems:

Name of the institution (school) Logo	
SKILLS AND ABILITIES OF THE TEAM MEMBERS	
NAME, SURNAME OF A STUDENT: ……………………………………………………... ……………………………………………………...	NAME, SURNAME OF A STUDENT: ……………………………………………………... ……………………………………………………...
Skills and abilities of a student:	Skills and abilities of a student:
NAME, SURNAME OF A STUDENT: ……………………………………………………. …………………………………………………….	NAME, SURNAME OF A STUDENT: ……………………………………………………….. ………………………………………………………..
Skills and abilities of a student:	Skills and abilities of a student:

Name of the institution (school) Logo
PROJECT TEAM MEMBERS‘ (STUDENTS) CONTRIBUTION TO THE PROJECT
Title of the project: ....
STUDENT *(Name, surname):* ....
Student‘s individual contribution to the project: 1. ... 2. ... 3. ... ...
Student‘s responsibilities (functions) foreseen at the beginning of the project: 1. ... 2. ... 3. ... ...

PROSPECTIVE CLIENTS FOR A SCIENCE SHOP PROJECT			Name of the institution Logo	
	Client (name)	Client (name)	Client (name)	Client (name)
Legal form				
Data (address, contact information)				
Field of activity				
Problems experienced by the prospective client				
Research needs and expectations				
Prospective client's experience of cooperation with higher education institutions in carrying out mutual research				
The desired benefit of the research to the potential client				
Opportunities for a potential client to be involved in and participate in the project				
Requirements for the project team				
Preferred duration of the science shop project and the deadline for submission of results				

PLANNING OF THE IMPACT FOR THE INTERESTED STAKEHOLDERS							Name of the institution Logo
Purpose of the impact	Client (Name)	Reasons for taking interest in the science shop project	Fields that encourage the involvement of the client in the science shop project	Data of the involvement of the client in mutual research (number, title)	Impact risks	Needs for resources	Desired deadline for project completion

PLANNING OF THE IMMEDIATE IMPACT/INFLUENCE								Name of the institution (abbreviation) Logo
Purpose of the impact/influence	Interested targeted groups/ public segments	Reasons for interest in the science shop project	Activities to encourage stakeholders to become involved in the science shop project	Indicators of successful stakeholder involvement (measured)	Impact/influence risks	Responsible persons	Need for resources	Deadline

Name of institution

Logo

STAKEHOLDERS OF THE IDENTIFIED PROBLEM

Problem:

A short description of a problem (essence): ....

A detailed description of a problem:

....

....

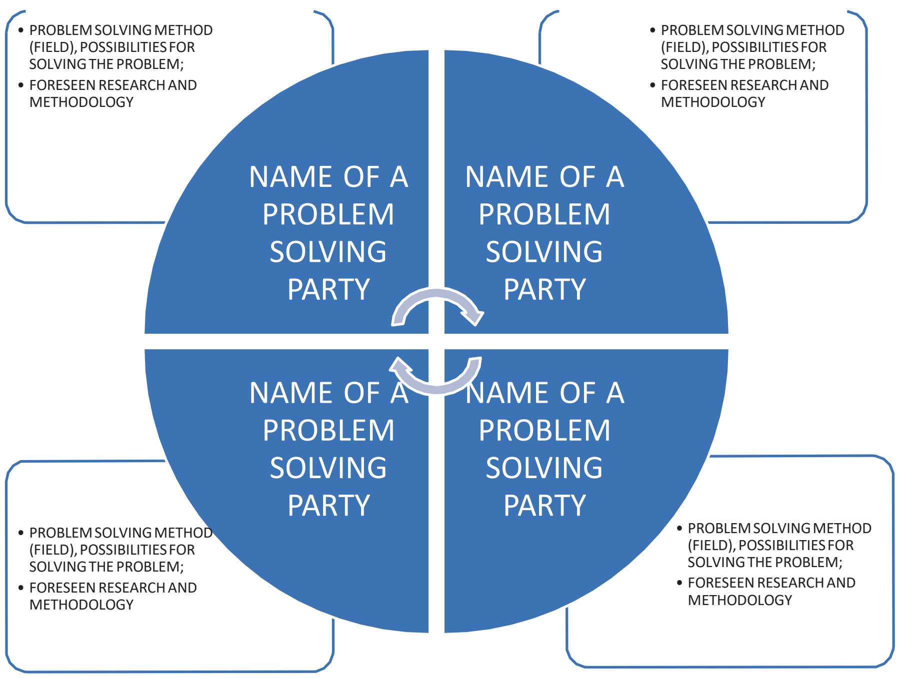
....

....

Possible stakeholders to solve the problem (all aspects):

1. ...
2. ....
3. ....
4.

STAKEHOLDERS OF A SOLUTION TO A REAL PROBLEM



Name of educational institution
Logo

REPORT OF THE SCIENCE SHOP PROJECT

Title of the science shop projects	
Period of the science shop project implementation (start-finish)	MMMM-XX-DD – MMMM-XX-DD
Project manager *(name, surname, study programme, year)*	
Project team (students), participants *(name, surname, study programme, year)*	
Project team (lecturers-researchers) *(name, surname, scientific degree, field and themes of research activities)*	
Project team (lecturers-consultants) *(name, surname, scientific degree, field and themes of research activities)*	
Client *(name, address, representative person (name, surname, position))*	

DETAILED DESCRIPTION OF A PROBLEM ADDRESSED BY THE PROJECT JUSTIFICATION OF THE RESEARCH NEEDS

TARGET GROUPS OF THE PROJECT

JUSTIFICATION OF THE INNOVATIVE NATURE OF THE PROJECT

DESCRIPTION OF RESEARCH USED AS THE BASIS FOR YOUR PROJECT

DESCRIPTION OF THE RESEARCH THAT WAS CONDUCTED TO SOLVE THE PROBLEM ADDRESSED BY THE PROJECT

THE RESULTS OF THE SCIENCE SHOP PROJECT

ANNEXES:
1. Template of a survey/interview questionnaire for a client, experts, etc. (depending on the need), and a summary and analysis of the obtained data;
2. Science shop project‘s implementation budget (estimates);
3. Description of the conducted research and report with a summary and analysis of the data;
4. Project suggestions and recommendations (depending on the nature of a science shop project);
5. Dissemination material of the science shop project (poster, presentation material, article, etc.);
6. Other (depending on the nature and needs of the science shop project).

	Name of the educational institution **Logo**

THE SCIENCE SHOP PROJECT TIMETABLE

Title of a science shop project	
Period of science shop execution	MMMM-XX-DD – MMMM-XX-DD

No.	Stage/activity	Science shop implementation week												The person responsible for the implementation of the stage/activity
		1	2	3	4	5	6	7	8	9	10	11	X	
1.	The initiation stage of the science shop project													
1.1.														
XX														
2.	The planning stage of the science shop													
2.1.														
XX														
3.	The implementation/execution stage of the science shop													
3.1.														
XX														
4.	The monitoring stage of the science													
4.1.														
XX														
5.	The completion and publicity stage of the science shop													
5.1.														
XX														

	Name of educational institution Logo

DESCRIPTION OF THE SCIENCE SHOP PROJECT

Title of the science shop project	
Period of the science shop prject implementation (start-finish)	MMMM-XX-DD – MMMM-XX-DD
Project manager *(name, surname, study programme, year)*	
Project team (students), participants *(name, surname, study programme, year)*	
Project team (lecturers-researchers) *(name, surname, scientific degree, field and themes of research activities)*	
Project team (lecturers-consultants) *(name, surname, scientific degree, field and themes of research activities)*	
Client *(name, address, the representative person (name, surname, position))*	

INITIAL VISION OF THE PROJECT (addressed problem, project purpose and goals, stages of the project, needs and expectations of a client, foreseen research and expected outcomes)

Name of educational institution

Logo

PLANNING OF THE SCIENCE SHOP PROJECT

Title of the science shop project	
Period of the science shop project implementation (start-finish)	MMMM-XX-DD – MMMM-XX-DD

	Project initiation stage	Project planning stage	Project implementation stage	Project monitoring stage	Project completion and dissemination stage
Purpose					
Goals					
Activities/actions					
Participants					
Budget (need for resources)					

Name of the educational institution Logo	
A SCHEDULE FOR SCIENCE SHOP PROJECT IMPLEMENTATION	
Title of a science shop project	
Period of science shop project implementation	MMMM-XX-DD – MMMM-XX-DD

Science shop project implementation week/date	**Task (work, actions)**
1st week	
2nd week	
X week	
MMM-XX-DD	**Consultation**
MMM-XX-DD	**Interim verification of the progress of the science shop project (monitoring)**
X week	
X week	
MMM-XX-DD	**Consultation**
MMM-XX-DD	**Interim verification of the progress of the science shop project (monitoring)**
X week	
X week	
MMM-XX-DD	**Consultation**
MMM-XX-DD	**Final assessment of the progress of the science shop project**
MMM-XX-DD	**Presentation of the science shop project**

Name of educational institution

Logo

SCIENCE SHOP PROJECT RISK ASSESSMENT

Title of the science shop project	
Period of the science shop project implementation (start-finish)	MMMM-XX-DD – MMMM-XX-DD
Client *(name, address, the representative person (name, surname, position)*	

RISK AREA	RISK DESCRIPTION	RISK LEVEL*	IMPACT ON THE PROJECT	MEASURES TO MITIGATE OR ELIMINATE RISK
Project initiation stage				
Human factor				
Time				
Finances				
Scope of activity				
...				
...				

RISK AREA	RISK DESCRIPTION	RISK LEVEL*	IMPACT ON THE PROJECT	MEASURES TO MITIGATE OR ELIMINATE RISK
Project planning stage				
Human factor				
Time				
Finances				
Scope of activity				
...				
...				

RISK AREA	RISK DESCRIPTION	RISK LEVEL*	IMPACT ON THE PROJECT	MEASURES TO MITIGATE OR ELIMINATE RISK
Project implementation and monitoring stage				
Human factor				
Time				
Finances				
Scope of activity				
...				

RISK AREA	RISK DESCRIPTION	RISK LEVEL*	IMPACT ON THE PROJECT	MEASURES TO MITIGATE OR ELIMINATE RISK
Project completion and publicity stage				
Human factor				
Time				
Finances				
Scope of activity				
...				
...				

*RISK LEVELS

RISK LEVEL	IMPACT
THE HIGHEST (>80 proc.)	Project stage/activity will fail (will not be implemented)
PROBABLE (50-80 proc.)	High risk for a project stage/activity to fail, a threat to continuity
POSSIBLE (25-50 proc.)	A significant drop in quality, a major impact on the results
RATHER UNLIKELY (5-25 proc.)	Insignificant impact on quality and results
LOW (0-5 proc.)	Minor impact on the implementation of stage/activity

STAKEHOLDERS IN FINDING A SOLUTION TO A PROBLEM (PUBLIC INTEREST)					Name of the institution Logo
Client (Name of an organisation, community, segment of society)	Possible need or interest in research	Aspects of the research that might interest the client	Foreseen possible impact of the client on the research and on its results; foreseen benefits of the research results	Remarks/comments regarding the possible impact and foreseen benefits of the research results (in light of time and content, etc.)	Ways of taking part in the conducted research

Name of the institution **Logo** **Name of the department/ faculty** **TASK FOR THE SCIENCE SHOP PROJECT**	
Title of the project	
Working group of the project: **Students** ***(Name, surname, study programme, year)***	
Project team (lecturers-researchers) *(name, surname, **scientific degree, field and themes of research activities)***	
Project team (lecturers-consultants) *(name, surname, **scientific degree, field and themes of research activities)***	
Client ***(name, address, representative person** (name, surname, **position))***	
Start of the project implementation	
End of the project implementation	
PROJECT DETAILS	
The problem addressed by the project	
Project purpose	
Project implementation plan (stages)	
Foreseen applied research	
Required additional resources	

Project working group leader ______________________ ______________________

Position Signature Name, Surname

Representative of the client,

______________________ ______________________ ______________________

Position Signature Name, Surname

Contact of the client: ______________________ ______________________

tel. No. Email address