AGH

University social responsibility report of AGH UST

2019–2020

Ladies and gentlemen,

Universities have a significant role in establishing and developing the Knowledge Society. Knowledge itself is built through work and cooperation between research and development teams and hence the increasing role of collaboration between the university, local authorities, and the business environment. These interconnected factors have a crucial role in strenghtening the position of the university in the society. It is the interdisciplinarity that lays down the basis for our activities.

Last year was most challenging for all of us. Due to the coronavirus outbreak, we made a great effort to help various groups in need, both within and outside our University. This is an excellent example of an initiative fully in line with USR. The commitment of the academic community at that time was deep and strong, and I am glad to see that we are able to make necessary sacrifices and stand together these days.

Building and maintaining meaningful relations with the university's surroundings requires constant dialogue with various groups of stakeholders, offering us an opportunity to define problems and search for an optimal solution. All social responsibility initiatives and activities are entirely voluntary. Therefore, I would like to thank the entire AGH UST community – both the staff and students, for their involvement, but also for the necessary identification of good practices in the USR area. Such activities and invitiatives foster our commitment to building a socially responsible university.

It is my pleasure to share with you AGH University of Science and Technology Social Responsibility Report. I am confident that in the future it will be recalled to strenghten the commitment to advancing the sustainable development goals and to raise public awareness in this respect. I would like to once again thank all the stakeholders for their hard work and their continued commitment and contribution.

Prof. dr hab. inż. Jerzy Lis
AGH UST Rector

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Introduction

In 2017 the AGH University of Science and Technology became a signatory of the United Nations Global Compact, an initiative bringing together over 9000 organisations and 5000 institutions all over the world. As a signatory, the AGH UST is committed to reporting (Communication on Engagement) on activities and initiatives fostering the integration of UN Global Compact principles into the university's core activity. The second report is submitted hereby, summarising the actions and initiatives aligned with economic, environmental and social issues addressed in 2019–2020 that stimulate the progress of the organisation and its key stakeholders: employees and students, as well as stakeholders and organisations in its external environment.

The report demonstrates the progress in implementation of the University's social responsibility principles. In 2019 the AGH University of Science and Technology became a signatory to the University Social Responsibility Declaration, alongside nearly 100 academic partners from Poland. It defines four major university functions with regard to cultivation of academic values, implementation of projects and research programmes pivotal for support of social responsibility initiatives, work organisation and fostering the collaboration with stakeholders.

University's social responsibility principles

Signatories of the University Social Responsibility Declaration undertake to:

1. Cultivate academic values, such as those outlined in the "Code of Ethics for Researchers", especially diligence, objectivity, freedom, accountability, and transparency.
2. Shape the social and civic attitudes of future elites that promote community building, creativity, openness, and communication, as well as social sensitivity and a culture of work.
3. Promote equality, diversity, tolerance, and respect and protect human rights in relation to the entire academic community and its environment.
4. Broaden the university curricula so as to include issues related to ethics and corporate social responsibility, sustainable development and social innovations.

5. Carry out projects implementing the principles of social responsibility, in particular concerning diversity management in the workplace, employee volunteering, promotion of ethics, intersectoral cooperation and socially engaged marketing.
6. Undertake research and implementation work that, in partnership with other academic centers from around the world, the business sector, public administration and non-governmental organizations, can contribute to solving important social problems.
7. Develop inter-university, national and international collaborations that enable the adaptation and enhancement of best practices in the field of university's social responsibility.
8. Maintain the university's organizational structure while establishing a foundation for management based on social responsibility, both in strategic documents and the resulting activities that contribute to the academic community's comprehensive development and effective implementation of the university's mission.
9. Ensure transparency of the activities of the university through, among other things,results measurement, promotion and dissemination of accomplishments, and indication of the of person or team to coordinate these activities.
10. Conduct operations in a way that minimizes the negative impact of activities carried out by the academic community and its stakeholders on the natural environment in all its dimensions.
11. Get engaged in a continuous stakeholder dialogue on the priorities of the university's social responsibility policy and disclose its results.
12. Adhere to the principles of ethics and responsibility in the process of teaching and research for the purpose of providing optimal conditions for stakeholders to benefit from the knowledge, intellectual capital and achievements of the university.

Source: University Social Responsibility Declaration

Thus the importance of the university mission is emphasised, demonstrating its commitment to promotion of social and civic attitudes among the future elite, supporting the development of the community and social sensitivity. The document emphasises the need to spread the idea of tolerance, equality and diversity and to incorporate the principles of respect and protection of human rights with regard to the entire academic community. Much attention is given to fostering the partnership between the university and business, enabling the development of research projects, which in turn, will lead to improvement of social and economic conditions.

Data quoted in the Report come from reports and statements released by organisational units of the AGH UST and supplied by representatives of all 16 faculties.

AGH UST faculties

WEAIiIB	Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering
WEiP	Faculty of Energy and Fuels
WFiIS	Faculty of Physics and Applied Computer Science
WGGiIŚ	Faculty of Mining Surveying and Environmental Engineering
WGGiOŚ	Faculty of Geology, Geophysics and Environmental Protection
WGiG	Faculty of Mining and Geoengineering
WH	Faculty of Humanities
WIEiT	Faculty of Computer Science, Electronics and Telecommunications
WIMiC	Faculty of Materials Science and Ceramics
WIMiIP	Faculty of Metals Engineering and Industrial Computer Science
WIMiR	Faculty of Mechanical Engineering and Robotics
WMN	Faculty of Non-Ferrous Metals
WMS	Faculty of Applied Mathematics
WO	Faculty of Foundry Engineering
WWNiG	Faculty of Drilling, Oil and Gas
WZ	Faculty of Management

Social initiatives

As one of the largest employers in the area, AGH UST ensures good and stable working conditions, encouraging the employees as well as students to acquire and improve professional and social qualifications, offering them a wide range of training courses and practical workshops, supporting or hosting cultural and sports events and leisure activities. AGH UST fosters the international collaboration, being an active partner for representatives of various sectors of industry operating the area and nation-wide. The proposed initiatives and solutions are subject to consultations with trade unions and representatives of students' organisations. Several initiatives have been undertaken for the benefit of various social groups, promoting the principles of equality and social justice. Thus the "Accessible university" program was launched, to support the development in areas of key importance for the disabled persons within the organisation. The AGH UST has actively collaborated with 86 schools and has offered most interesting courses, within the framework of the AGH UST Junior Academy project. Moreover, there is the Alumni Association and the AGH UST Students' and Graduates' Association, several university science groups, clubs as well as student organisations.

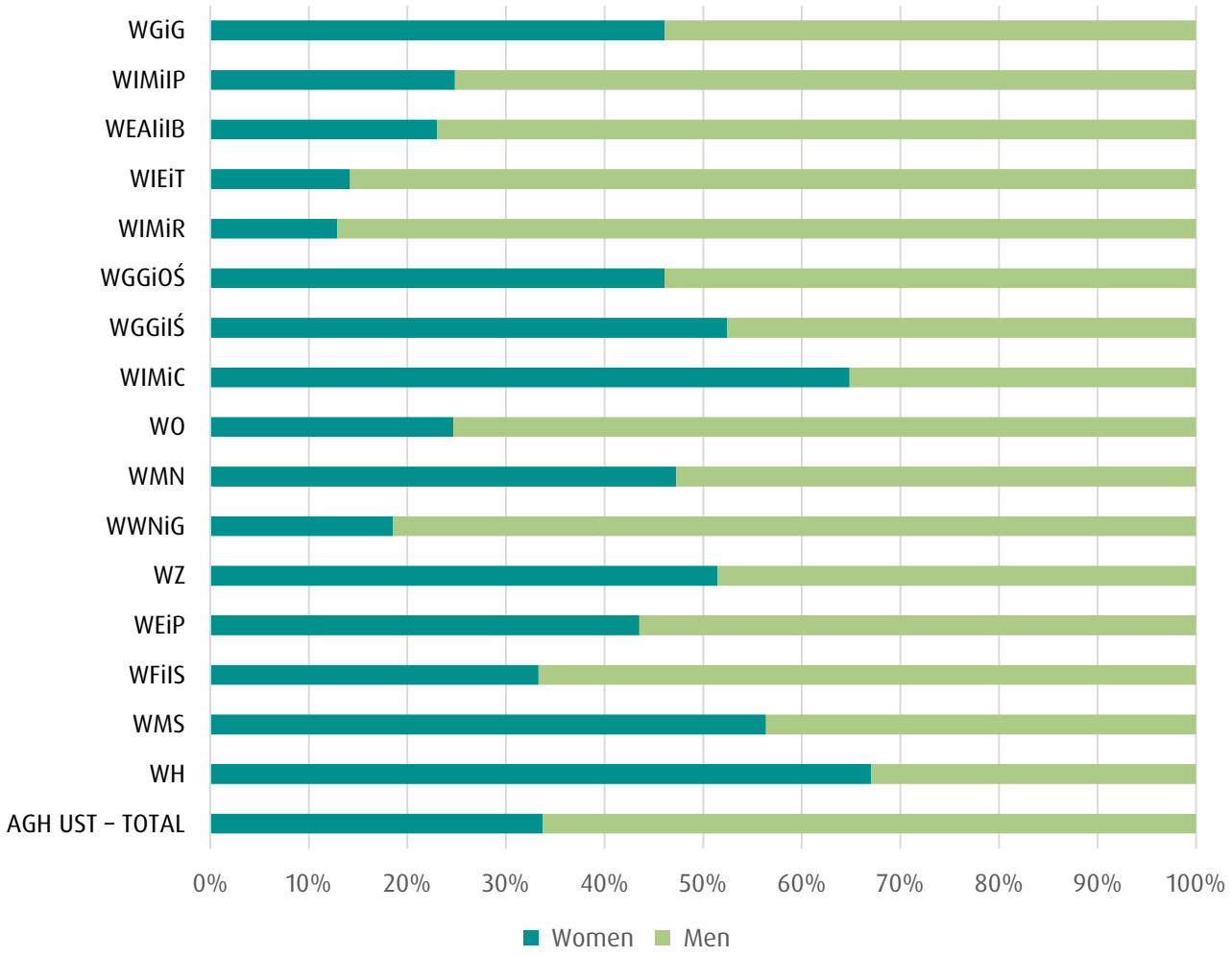
Monitoring the social structure of the university

AGH UST employees and students – gender breakdown

The data on the gender breakdown of AGH UST employees as well as the numbers (headcount) of female and male students at each Faculty and in major research areas are duly collected and reported.

Presently, nearly 25% of AGH UST students are female (the largest proportion of female students is reported at the Faculty of Humanities, the Faculty of Materials Science and Ceramics and the Faculty of Applied Mathematics (Fig. 1). Among full-time students, the proportion of girl students is 36%.

Fig 1. Full-time and part-time students including international students as of the day 31.12.2020 (by faculty)



According to the "Girls As Engineers" Report in 2020, the AGH UST is the pioneer in Poland in terms of the percentage of women preparing for so-called modern technical directions, such as biomedical engineering, computational engineering, IT, econometrics and geoinformatics*.

The proportion of women among the AGH UST employees is fairly stable (about 45% female employees) though the proportion of women at senior academic positions (post-doc positions, university professors or full professors) still tends to be relatively low. Considering the range and scale of initiatives undertaken to enable the wider participation of women in research activities at technical universities, it is reasonable to expect a gradual reversal of this trend.

* Perspektywy Education Foundation, Girls As Engineers Report 2020.

Employment structure

Table 1. Employment structure at AGH UST (on 30.10.2020)

		Total (headcount)	Women (headcount)
AGH UST total staff		**4,168**	**1,893**
Academic staff members (teachers)		2,172	659
incl.	Full professors	212	31
	AGH UST professors	520	126
	Assistant professors	1,039	325
	Assistants	312	110
	Senior lecturers in a foreign language	40	36
	Lecturers in a foreign language	26	23
	Senior instructors	17	5
	Instructors	6	3
Non-academic staff members		1,996	1,234
incl.	Librarians	100	89
	Research suport staff	47	12
	Technical staff	565	123
	Administrative staff	911	752
	Service staff	319	258
	Labourers	54	0

Promotion of AGH UST among school attendees

In order to foster the links with the AGH UST the Section for Education has undertaken a number of initiatives to encourage the youngest children from primary schools in the area to develop new interests and thus enter a path leading to the studies at the AGH UST. The AGH UST Junior Academy involves lectures, practicals and lab classes dedicated for children aged 8–12 and taught by specialists and researchers with a wide expertise. The main objective is to present the world of science in such manner as to encourage the youngsters to ask questions, seek information and develop their passions.

In response to negative demographic trends and the decreasing number of candidates, the activities of the AGH UST have now focused on attracting the best candidates through fostering collaboration with schools and through organisation of national-level competitions and educational courses. Presently AGH UST actively collaborates with 86 schools

in Poland. In 2018 the **Year Zero** project was launched, involving a preparatory course in maths, physics and chemistry, dedicated to candidates willing to enrol on the AGH UST. The "Year Zero" project has become immensely popular, offering instruction in the form of lectures as well as e-learning courses made available to candidates by the AGH UST Centre of e-Learning (Table 2).

Table 2. "Year Zero" courses in the period 2016–2019 – number of participants

		2019	2018	2017	2016
Number of course groups	Maths	98	87	83	57
	Physics	9	8	9	12
	Chemistry	9	20	16	10
	Geography	0	2	1	2
	TOTAL	**116**	**117**	**109**	**81**
Number of course participants	Maths	1,941	1,793	1,753	1,145
	Physics	153	160	189	235
	Chemistry	179	408	308	208
	Geography	0	46	21	49
	TOTAL	**2,273**	**2,407**	**2,271**	**1,637**
Lectures delivered by AGH UST teachers at schools attended by the participants		133	51	83	74

Source: *The AGH UST Rector's Report on the University's Activity in 2019*

One of the major initiatives launched by the AGH UST is the AGH UST **Top Student** programme, aimed to attract top class rank secondary school graduates, laureates and winners of national-level school contests. Top rank school graduates who enrol on studies at AGH UST enjoy the following benefits:

- individual study program and tutor's supervision;
- free-of-charge accommodation at the students' hall of residence during the first year of study;
- an opportunity to participate in additional activities (courses, training sessions, workshops, internship, placements), free of charge.

Each year the number of students who enrol on AGH UST, encouraged by this programme, is growing. In 2019 the number of beneficiaries under the programme was 816 (see Table 3) with only 269 students the year before. A significant increase is well apparent, showing the attractiveness and effectiveness of the programme.

Table 3. List of courses opened in 2019, the number of participants and the number of top candidates not participating in any courses

Faculty	Course designation	Number of participants
WIEiT	Fundamentals of data science	80
WIEiT	Introduction to cryptography and security issues	80
WFiIS	Excursions to European Organisation of Nuclear Research CERN in Geneva	70
WIEiT	Fundamentals of Java programming	60
WEAIiIB	"Underwater Kraków" – Open Water Diving course	50
WIEiT	Development of state-of-the-art internet applications	47
WIEiT	Programming of mobile applications	45
WIEiT	Programming of mobile robots	36
WGGiOŚ	Course for candidates for Internal Auditors of the Occupational Health and Safety System OHSAS 18001	35
WIEiT	CCNA Routing and Switching	35
WIEiT	Programming of internet applications in PythonDjango	32
WGGiOŚ	Use of AutoCAD (including and exam and the issue of certificates)	30
WIEiT	Optimisation of codes in C/C++	30
WIEiT	Maker – creative design and programming of electronic gadgets	28
WIEiT	Programming in C++	15
WIEiT	Introduction to programming in Python	15
	Those not willing to take a course	128
	TOTAL	**816**

Source: *The AGH UST Rector's Report on the University's Activity in 2019*

Reports released by the Education Section reveal a definite trend evidencing the growing popularity of studies in the field of IT among top rank secondary school graduates embarking on degree programmes at the Faculty of Computer Science, Electronics and Telecommunications and at the Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering (Table 4).

Table 4. Number (headcount) of top class rank school graduates by faculty

2018		2019	
Faculty	Headcount	Faculty	Headcount
WIEiT	138	WIEiT + WEAIiIB	248
WEAIiIB	57	WEAIiIB	148
WIMiR	21	WIEiT	85
WFiIS	10	WFiIS	77
WGGiOŚ	9	WIMiR	68
WGiG	5	WMS	39
WMS	5	WH	37
WGGiIŚ	5	WGGiOŚ	35
WIMiC	5	WZ	25
WZ	4	WGiG	18
WH	4	WEiP	12
WEiP	3	WGGiIŚ	6
WWNiG	1	WIMiC + WIMiIP	5
WIMiIP	1	WWNiG	4
WO	1	WEiP + WIMiC	3
TOTAL	**269**	WIMiIP	3
		WIEiT + WH + WIMiC	2
		WMN	1
		TOTAL	**816**

Source: *The AGH UST Rector's Report on the University's Activity in 2019*

Another initiative successfully launched is the AGH UST **Diamond Index Competition** in five school subjects: maths, physics, computer science, geography with fundamentals of geology. The competition involves three levels: the school level and the regional and nation-wide level and participants with top score on the national level (in excess of 70%) are declared laureates. They are admitted as 1st year students without the need to satisfy the university's admission requirements. This nation-wide contest is held under the auspices of the Ministry of Science and Higher Education, the Ministry of National Education and the European Centre for Nuclear Research CERN in Switzerland.

Alongside the afore-mentioned competitions, other AGH UST initiatives aimed at promotion of science among young people include the "See Maths" contest, or the "Friday Night Science Session" held on the World Pi Number Day (14th March = 3.14) and the Hoborski Science Day – an initiative first launched several years before. These events each year attract dozens of students eager to widen their horizons and gain new knowledge.

The AGH UST aims to attract the best candidates, students and distinguished researchers. All those initiatives are immensely popular among young people, motivating them to pursue their career in the broadly understood world of science.

Activities for the student community

AGH UST Student Campus

The AGH UST can boast of the largest students' campus in Poland, located in the neighbourhood of the main complex of university buildings and close to a park. There are 20 students' halls of residence offering accommodation to over 7,000 students from all universities in Cracow. An excellent locality, high standard of accommodation at relatively low price has attracted great numbers of AGH UST full-time students. The Campus also offers access to green space and sports facilities, free of charge. Students can make the booking to use the following sports facilities:

- football pitch
- volleyball court,
- basketball field,
- tennis courts,
- other facilities, including small-scale gyms in several buildings.

Cultural life

The AGH UST Campus has now become a popular cultural centre hosting over 360 events each year: concerts, stand-ups, exhibitions, vernissages and others. There are four student clubs:

- Academic Cultural Centre "Studio" Club
- Student Club "Zaścianek"
- Student Club "Gwarek"
- Student Club "Filutek"

The "Studio" Club has invited well-known stars and celebrities whilst the University Student Council as a co-host of most cultural events sees to it that the tickets are readily affordable to students. Besides, to celebrate the 100th anniversary of the university, the The Mining & Metallurgy Brewery was opened (as a joint-stock company, the entire academic community being the partner in the enterprise), producing top-quality beer, in line with the old mining traditions.

The clubs are the property of the AGH UST, they are managed and operated by the Academica Students' and Graduates' Foundation, which has served students for several years and the quality of the service has steadily improved. The Foundation is also a place where students living on the Campus can seek employment, giving them an opportunity to support themselves without the need to look for jobs far from their place of residence during their studies.

The best known events held at the AGH UST Campus and dedicated to the entire academic community include:

- The Kraków Juvenalia festival,
- Synestezje Festival. Music. Visual Art. Word,
- Entre'acte Events,
- Miners' and Metallurgists' Beer Festival.

The Foundation has also managed the ACK Music Studio "Kotłownia", offering student organisations, such as AGH UST Orchestra and the Con Fuoco Choir, a unique opportunity to pursue their passion for music.

That the access to a music studio has played a positive role is evidenced by a great number of achievements in this field, the most spectacular success came recently when the AGH UST Orchestra won the Concert Competition at the WAMSB World Championships in Calgary, Canada*.

ADAPTER Programme launched by the Section for Student Affairs

In collaboration with the University Student Council, the Section for Student Affairs has successfully coordinated the ADAPTER programme, dedicated to students. It was launched to support students with regard to psychological, social and healthcare issues. There are webinars, counselling sessions, as well as lectures explaining how to effectively cope with stress, adapt in a new environment and how to perform on the job market.

As a part of this initiative, students have an access to the Consultation Centre where counselling services (psychologist consultations) are provided free of charge for students, thanks to financial support given by the AGH UST.

BON – AGH UST Disabled Support Service

The AGH UST is committed to supporting people with disabilities who face considerable difficulties with gaining knowledge and adaptation in the new surroundings. In 2000 the

* https://www.agh.edu.pl/en/osiagniecia/info/article/oragh-wins-at-canada-held-marching-bands-event/.

AGH UST Disabled Support Service was established, its main objective was to implement the programme "AGH UST – Disability Friendly University".

In 2020 the new project was launched: "Academy of Accessibility – reinforcement of the AGH UST potential of supporting the disabled persons", its subsidies amounting to 12.8 mln PLN. The project is aimed to improve the accessibility of the AGH UST architectural infrastructure and to foster implementation of advanced technologies supporting education.

AGH UST at the time of COVID-19 pandemic

Upon the outbreak of the COVID-19 pandemic AGH UST made a great effort and launched several initiatives aimed to limit the negative impacts of the epidemic on stakeholders. The list of selected initiatives launched by the students as well as AGH UST authorities and employees is presented below.

Implementation of online teaching

AGH Centre of e-Learning (CeL AGH) is a unit supporting online education, publishing e-textbooks and holding webinars. CeL AGH has held numerous training sessions, newsletters, provided several dozen virtual rooms (each for 100 people, available to all), and provided students and teachers with the dedicated software for remote communication and learning, including Microsoft Teams.

Counselling hotline

In response to challenges posed by the pandemic, the AGH UST launched the online counselling helpline providing the support service and space to talk with psychologists under the ADAPTER program. Consultations are held by experts from the Psychotherapy and Neurorehabilitation Centre Sensusmed. In addition, the AGH UST Student Campus set up a telephone crisis counselling hotline.

AGH UST Medical Shields for Medics

The project "AGH UST Medical Shields for Medics" involved the design, 3D printing and assembly of medical shields providing COVID-19 protection, and their distribution among medical staff in local healthcare centres. From March to May 2020 over 22,000 shields were thus manufactured (on 3D printers either privately owned or being the AGH UST property), including 20,000 shields assembled at AGH UST and then dispatched to 207

institutions in 72 towns. Over 250 people were involved in the project, which proved to be one of the most successful initiatives taken by the academic community.

AGH UST racing for benefit of the University Hospital

Students – members of the AGH Racing team, presented the University Hospital in Kraków with 500 face filter masks originally designed to protect airways of students working on a new bolid car.

AGH UST Sanitary Inspectorate Support Centre

In 2020 the AGH UST launched a project committed to supporting the activities of the Sanitary-Epidemiological Centre Sanepid. The main responsibility of the AGH UST is to gather and process data for the regional Sanitary-Epidemiological Station. The university provides the required infrastructure whilst the University Student Council has coordinated the work of volunteers.

#grunwald2020

As part of the campaign, employees of the Faculty of Energy and Fuels donated 30 litres of ethyl alcohol, protective face masks, gloves, glasses and other cleaning products to the University Hospital in Kraków. Among other participants were students – members of the research association "AGH Solar Plane".

Aider app

Students from the Faculty of Metals Engineering and Industrial Computer Science (Natalia Fitowska and Szymon Stasik) have created an application which enables people in need to get in touch with volunteers. The main purpose of the app was to help the elderly, disabled or quarantined in obtaining help in everyday activities, e.g. taking the rubbish out or going to the pharmacy. The person in need enters the data in the app and volunteers have access to the these, with easy reference to the map. The use of this app is free of charge.

UNIKEY – a tool for contactless door opening

Daniel Wieczorek, a student of the Faculty of Mechanical Engineering and Robotics, created UNIKEY – a tool for contactless opening of doors and holding handrails and handles in public transport vehicles. Thus, the risk of infection with the coronavirus is minimized, especially in public spaces.

Cybersecurity issues in the pandemic era

As part of the ECHO project (Horizon 2020), an expert meeting was held to discuss the impacts of pandemic on cybersecurity levels. The final document released after the meeting contained information on the profile of hackers in the pandemic era, their model of operation and a set of rules regarding the safe use of Internet services (among those participating in the project were Prof. Andrzej Dziech, M. Eng. Jan Derkacz and Dr. Eng. Marcin Niemiec.

Online Hackathon "EduShock. Education after the Pandemic"

Over 50 people (8 teams) participated in the Hackathon (May 29–31, 2020) aimed at improving the effectiveness of the education system. The mentors were experts and specialists in the areas of software engineering, design, education, coaching and management from leading companies such as ABB, Google, Motorola Solutions, ClickMaster and the Kraków Technology Park. The prizes in money were funded by the AGH UST Rector (15,000 PLN), ABB (the special prize – "Cloud Computing – from zero to hero" training) and Motorola Solutions – prizes in money for the three winning teams.

Research infrastructure in the pandemic era

The AGH UST Academic Computer Centre CYFRONET is the owner of the fastest computer in Poland – Prometheus, which supports research solutions relating to the coronavirus SARS-CoV-2 and the COVID-19 disease. Extensive studies were undertaken to explore and examine the antibodies present during infection, molecules with a potential to inhibit infection, and potentials of vaccine development. Within the framework of the PRACE European Partnership, a proportion of the computing power has been used to conduct European Hackathon to develop new solutions aimed at fighting the coronavirus outbreak.

Modelling the spread of COVID-19 disease

The aim of the project, developed by the Student Research Association "Glider", was to model the spread of COVID-19 disease using powerful computers. Novel solutions include microscopic and mesoscopic models, implementable thanks to the high-power architecture.

Educational initiatives

Initiatives aimed to develop interdisciplinary programmes – in academic year 2019/2020

At AGH UST there is a longstanding commitment to enhance the interdisciplinary aspect of education. It is a technical university offering engineering programmes, alongside the studies of exact sciences, science, economics and social sciences. Attempts are being made to integrate and combine the fields, their perspectives and methods to boost collaboration, research and education.

Initiatives promoting interdisciplinary programmes

There are 22 fields (major areas) involving the combination of several academic disciplines (Table 5). Those of particular importance include:

- Advanced Technologies in Forensic Criminalistics – an interdisciplinary fields giving the professional insight in Computer Forensics (CF) or forensic analysis involve the combination of IT and telecoms, legal sciences, sociology and chemistry;
- Social Informatics – an interdisciplinary programme involving the combination of social sciences with IT and telecommunications. Students can choose between two routes: Design and Product Development (design of interactive products such as to enhance their reception by the users and to support the data analysis, gathering and storage), or Artificial Intelligence and Data Mining (advanced techniques of database analysis and exploration);
- Micro- and Nanotechnologies in Biophysics – a programme combining physics, biological science, IT, telecommunications, automatics, electronics and electrical engineering.

Table 5. Interdisciplinary programmes at AGH UST in 2019/2020

Degree programme	Level of study	Major discipline		Other disciplines	
		Name &	Contribution	Name &	Contribution
IT	1st cycle	IT and telecoms	91%	Materials Engineering	9%
Thermal Engineering	1st cycle	Mechanical Engineering	60%	Materials Engineering Environmental Engineering, Mining and Power Engineering	21% 19%
	2nd cycle	Mechanical Engineering	63%	Materials Engineering Environmental Engineering, Mining and Power Engineering	21% 16%
Electronics and Telecommunications	1st cycle	Automatics, Electronics and Electrical Engineering	71%	IT and Telecommunications	29%
	2nd cycle	Automatics, Electronics and Electrical Engineering	64%	IT and Telecommunications	36%
Computer Science	1st cycle	IT and Telecommunications	51%	Computer Science	49%
	2nd cycle	IT and Telecommunications	51%	Computer Science	49%
Advanced Technologies in Criminalistics	1st cycle	IT and Telecommunications	51%	Law Sociology Chemistry	21% 13% 15%
Automatics and Robotics	1st cycle	Mechanical Engineering	55%	Automatics, Electronics and Electrical Engineering	45%
	2nd cycle	Mechanical Engineering	54%	Automatics, Electronics and Electrical Engineering	46%
Acoustic Engineering	1st cycle	Mechanical Engineering	69%	Automatics, Electronics and Electrical Engineering IT and Telecommunications Environmental Engineering, Mining and Power Engineering	17% 10% 4%
Materials and Mechanical Engineering	1st cycle	Mechanical Engineering	84%	Materials Engineering	16%
Mechatronic Engineering	1st cycle	Mechanical Engineering	68%	Automatics, Electronics and Electrical Engineering IT and Telecommunications	23% 9%
	2nd cycle	Mechanical Engineering	80%	Automatics, Electronics and Electrical Engineering IT and Telecommunications	13% 7%

Degree programme	Level of study	Major discipline		Other disciplines	
		Name &	Contribution	Name &	Contribution
Mechanics and Machine Design	1st cycle	Mechanical Engineering	94%	Automatics, Electronics and Electrical Engineering	4%
				Materials Engineering	2%
	2nd cycle	Mechanical Engineering	97%	Materials Engineering	3%
Geoinformatics	1st cycle	Earth and related Environment Sciences	75%	IT and Telecommunications	25%
	2nd cycle	Earth and related Environment Sciences	67%	IT and Telecommunications	33%
Data Analysis and Engineering	1st cycle	Earth and related Environment Sciences	75%	IT and Telecommunications	25%
Geodesy and Cartography	1st cycle	Civil Engineering and Transport Systems	85%	Environmental Engineering, Mining and Power Engineering	15%
	2nd cycle	Civil Engineering and Transport Systems	84%	Environmental Engineering, Mining and Power Engineering	16%
Geoinformation Systems	1st cycle	Civil Engineering and Transport Systems	70%	Environmental Engineering, Mining and Power Engineering	20%
				IT and Telecommunications	10%
	2nd cycle	Civil Engineering and Transport Systems	70%	Environmental Engineering, Mining and Power Engineering	20%
				IT and Telecommunications	10%
Environmental Engineering and Monitoring Systems	1st cycle	Environmental Engineering, Mining and Power Engineering	85%	Civil Engineering and Transport Systems	15%
	2nd cycle	Environmental Engineering, Mining and Power Engineering	90%	Civil Engineering and Transport Systems	10%
Informatics and Econometrics	1st cycle	Management and Quality studies	67%	Economics and Finances	33%
	2nd cycle	Management and Quality studies	83%	Economics and Finances	17%

Degree programme	Level of study	Major discipline		Other disciplines	
		Name &	Contribution	Name &	Contribution
Production Management and Engineering	1st cycle	Mechanical Engineering	52%	Management and Quality studies	48%
	2nd cycle	Mechanical Engineering	51%	Management and Quality studies	49%
Physics in Medicine	1st cycle	Physics	80%	Automatics, Electronics and Electrical Engineering	8%
				IT and Telecommunications	4%
				Medicine	8%
	2nd cycle	Physics	88%	Medicine	7%
				Automatics, Electronics and Electrical Engineering	5%
Technical Physics	1st cycle	Physics	65%	Mathematics	18%
				Automatics, Electronics and Electrical Engineering	10%
				IT and Telecommunications	7%
	2nd cycle	Physics	98%	Automatics, Electronics and Electrical Engineering	2%
Applied Computer Science	1st cycle	IT and Telecommunications	73%	Automatics, Electronics and Electrical Engineering	5%
				Mathematics	15%
				Physics	7%
	2nd cycle	IT and Telecommunications	85%	Automatics, Electronics and Electrical Engineering	6%
				Physics	9%
Micro- and Nanotechnologies in Biophysics	1st cycle	Physics	85%	Biological Sciences	4%
				IT and Telecommunications	6%
				Automatics, Electronics and Electrical Engineering	5%
	2nd cycle	Physics	84%	Biological Sciences	13%
				Automatics, Electronics and Electrical Engineering	3%

Degree programme	Level of study	Major discipline			Other disciplines		
		Name	&	Contribution	Name	&	Contribution
Social Informatics	1st cycle	Sociology		70%	IT and Telecommunications		30%
	2nd cycle	Sociology		70%	IT and Telecommunications		30%

Source: AGH UST sources

One of the organisational forms of supporting interdisciplinary education and programme at the AGH UST are "combined/interdisciplinary programmes" (Table 6) utilising research facilities of two or more Faculties, which guarantees high quality of teaching and prevents the knowledge isolation in information silos. Whenever practicable and justified, interdisciplinary degree programmes are being launched to effectively counterbalance narrow specialisations. In the academic year 2019/2020 there were five interdisciplinary degree programmes in the AGH UST educational offer.

Table 6. Interdisciplinary programmes at AGH UST in 2019/2020

Interdisciplinary programme	Faculties that launched joint programmes
Computer Science (in English)	WEAIiIB in collaboration with WIEiT, WFiIS, and WIMiIP
Materials Engineering	WIMiIP and WIMiC
Chemical Process Technology	WEiP and WIMiC
Computer Science	WIEiT and WEAIiIB
Advanced Technologies in Forensic Criminalistics	WIEiT in collaboration with WH and WIMiC

Source: AGH UST sources

The offer of interdisciplinary programmes was reinforced and expanded when degree programmes in English were launched, combining the engineering knowledge with linguistic achievements (technical English). In the last few years the number of majors and courses taught in English has increased significantly. All 16 Faculties have in their offer both undergraduate and graduate degree programs and courses taught in English.

An important component of the AGH UST offer supporting the interdisciplinary aspect of university education via reinforcing the students' general knowledge is the AGH UST database of elective courses. In the academic year 2019/2020 it included 65 courses in arts and humanities, including courses taught in foreign languages. Furthermore, from

the academic year 2020/2021 on, students will have an opportunity to enrol on courses selected from the **Block of Innovative Courses**. Thus, students will be able to complete both the core modules as well as choose elective subjects, for example: Economics of values and social impacts – real project management.

Offer for international students

The AGH UST has launched numerous initiatives and actions in support of the interdisciplinary education and to promote AGH UST as a brand, both on the domestic and international market, encouraging international students to enrol. In relation to the number of undergraduate and graduate students from abroad, the leading Faculty is the Faculty of Management with the "International Business" major in its offer. The second in line is the Faculty of Computer Science, Electronics and Telecommunications where students have an opportunity to study Electronics and telecommunication in English.

AGH UST initiatives in support of interdisciplinary programmes

The academic year 2019/2020 marked the 100th anniversary of foundation of our University whereby its rich history was recollected and new directions for further development were defined for the decades to come. In the same year the AGH UST was among the 10 universities in Poland that were awarded the most prestigious title of the **"Research university"**, the interdisciplinary character of research (involving exact sciences, biological sciences and technical and engineering fields) being regarded as the distinguishing feature, whilst the top priority research areas included: "water-energy-climate" – showcasing an interdisciplinary approach to sustainable development and "crossing boundaries" – experimental high energy physics and extreme states of the matter – interdisciplinary applications.

The AGH UST Development strategy promotes the "creation of inter-departmental and interdisciplinary research teams or centres implementing the top priority research projects". In the academic year 2019/2020 two research centres acted actively: the Academic Centre for Materials and Nanotechnology and the AGH UST Centre for Energy where lab classes are held attended by students from several faculties.

In the academic year 2019/2020 the international cooperation network Intelli-Net (Artificial Intelligence Academic Platform) is to be launched, to promote research into immersion technologies.

AGH UST representatives in national-level organisations

AGH UST has been a member of numerous cooperation initiatives and organisations. Thanks to active membership in executive committees and governing bodies, the AGH UST is able to participate in high-level decision making in the area of university education in Poland. AGH UST representatives are members of executive committees and boards of the following organisations: Conference of Rectors of Academic Schools in Poland (KRASP) and Conference of Rectors of Polish Universities of Technology (KRPUT).

From 2016 to 2020, Prof. Tadeusz Słomka, the AGH UST Rector at that time, was the President of the Conference. He was awarded the title of the Honorary President for the following term of office (2020–2024) in recognition of his merits and contribution.

AGH UST doctoral students and the Council of Doctoral Candidates actively participate in the activities of the Polish National Association of Doctoral Candidates (KRD). From 2018 to 2020, the AGH UST representative – Ms Jolanta Krupa (MSc) was the head of the Audit Committee.

Moreover, students represented by the AGH UST University Student Council have participated in the activities of the Students' Parliament of the Republic of Poland. From 2018 to 2020, the AGH UST was represented by Mr Jakub Grodecki (MSc), who was later appointed Vice-President of the European Student Union.

Representatives of AGH UST have activated participated in the activities of Forum of Technical Universities.

Excellence Initiative – AGH UST as a research university

In 2019, the winners in the first competition in the "Excellence Initiative – Research University" (IDUB) program of the Ministry of Science and Higher Education were announced. Ten top universities in Poland were selected basing on duly submitted detailed plans of research activities and initiatives aimed to boost the dissemination of research results on the international level and to improve their competitiveness. Thus, the AGH UST found itself in the 3rd place*.

Following this spectacular success, the AGH UST is now entitled to receive the government subsidy increased by 10% from 2020 to 2026, to effectively pursue research projects in 8 priority areas defined in the application document. One of the main objectives at the AGH UST was to boost its international standing and transform it into a modern technical

* https://www.agh.edu.pl/en/initiative-for-excellence-research-university/news/info/article/agh-ust-among-10-winners--in-competition-to-become-research-university.

university which, in the next 10–15 years, was to become a most attractive place for studies and work, effectively competing with European universities. Increased government subsidies for research (by nearly 370 million PLN in the next 7 years) should allow the academic staff to focus on research activity and on improving the quality of teaching. Chief beneficiaries of the extra funding are research teams that pursue projects in priority research areas. The following top research areas have been defined at AGH UST:

- Sustainable energy technologies, renewable sources of energy, and energy storage;
- New technologies for the circular economy;
- Water-energy-climate: interdisciplinary approach to sustainable development;
- Technical solutions: from basic research, through modelling and design, to prototypes;
- Materials, technologies and processes inspired by nature;
- Intelligent information systems, telecommunications, computer and control technologies;
- Design, production and testing of advanced materials and the technologies of the future;
- Crossing boundaries – experimental high energy physics, extreme states of matter, transdisciplinary applications.

AGH in the European Universities Initiative

Recently, the AGH UST achieved the status of an European University in the second call of European Universities Initiative competition launched by the European Commission.

The main objective of the UNIVERSEH (European Space University for Earth and Humanity), an alliance of European higher education institutions, including AGH UST, Université de Toulouse (France), Université du Luxembourg (Luxembourg), and Heinrich-Heine-Universität Düsseldorf (Germany), is to promote education, research and technologies in the area of space exploration*.

* https://www.agh.edu.pl/en/news-pl/info/article/universeh-officially-launched/.

Economic initiatives and cooperation

AGH UST economic initiatives include the statutory activities and additional projects to boost the education and teaching quality, to support commercialisation and transfer of technologies, to enhance the students' and employees' mobility. The effects of these efforts boost the AGH UST financial performance, enhance intensity and scope of international collaboration which, in turn, results in improved competitiveness of the organisation, both on the national and international level.

The university's stable financial position is attributable to the effective system of fund raising from external public and private sources and to rational management of the subsidy money (Table 7).

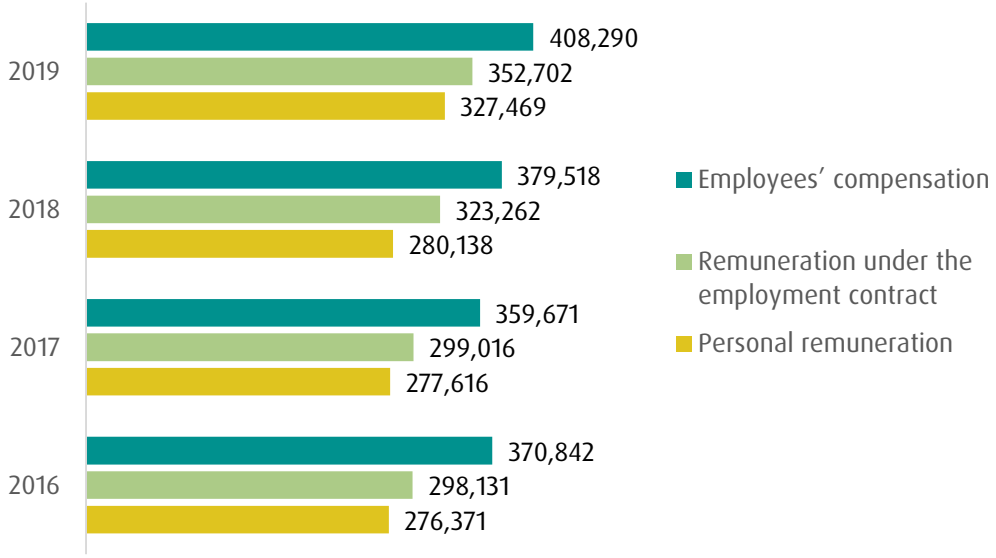
Table 7. AGH UST financial performance in the years 2016–2019 (in PLN thousand)

	2016	2017	2018	2019
Financial performance	40,347	36,743	32,949	91,861

Source: *The AGH UST Rector's Report on the University's Activity in 2019*

In the period 2016–2019 the employees' compensations showed a growing trend.

Fig 2. AGH UST employees' compensation from 2016 and 2019 (in PLN thousand)



Source: *The AGH UST Rector's Report on the University's Activity in 2019*

Financing the AGH UST activity from the Ministry of Science and Higher Education sources

In 2019 the Ministry of Science and Higher Education allocated 11,094,874.7 thousand PLN to be distributed between 64 universities in Poland, depending on the assessment of their development potentials. In accordance with the Annex to the announcement of 30.04.2019 released by the Ministry of Science and Higher Education, the AGH UST received 523,120.2 million PLN, which proved to be the highest sum allocated to a technical university.

Initiatives aimed to foster collaboration with external stakeholders in the area of innovations

As it was emphasised in the AGH UST Development Strategy document released in 2017, the AGH UST is committed to collaboration with external stakeholders, both on the national and international level, in the areas of education and research. A vital element of such strategy is the creation of the network of collaborating universities, research centres and R&D departments from industry. The AGH UST strives to build its position within the consortium of academic and business entities by pursuing its economic initiatives and creating favourable conditions for development and transfer of technologies.

The AGH UST potential in this area lies in the ownership of intellectual property, including patents, trademarks, utility patterns and inventions. The AGH UST Centre for Transfer of Technology is responsible for creating mechanisms facilitating and intensifying the transfer of innovative technologies and know-how from the AGH UST to entrepreneurs and other external institutions.

In 2010 the Krakow Centre of Innovative Technologies INNOAGH was established, with 100% share capital owned by the AGH UST. The INNOAGH Centre acts as a quasi- investment fund, providing advice and support services, encouraging investments in innovative companies based on intellectual property originating at the university.

The AGH UST Section for Cooperation with Administration and Economy has launched and coordinated programmes initiated by the university and its faculties fostering collaboration with external organisations, thus promoting the AGH UST research potential.

The virtual Innovation and Technology Highway Institute (IATI) was set up to effectively integrate research work pursued by universities, independent R&D institutes and industry. Presently, there are 50 IATI partners, including 24 universities, 8 R&D institutes and 18 firms.

Collaboration agreements and memoranda of understanding

Each year the AGH UST enters into understandings and signs numerous collaboration agreements with external partners (more than 60 agreements in 2019). The AGH UST partners are mostly business enterprises and firms based in the vicinity of Kraków and in the Małopolska Province, which emphasises the leading role of the AGH UST in creation of reginal network of innovation.

That the university enjoys a high renown and has a vast potential to build partnership bringing considerable financial effects is evidenced by agreements entered into with the following partners:

- JSW SA (Jastrzębska Spółka Węglowa),
- CAN-PAK S.A.,
- Comarch SA,
- Enea Wytwarzanie (Enea Production, PLC),
- Cisco International Limited,
- „Balon Widokowy" Limited.

Among other partners are universities and research institutes:

- Lodz University of Technology,
- Wrocław University of Science and Technology,
- Silesian University of Technology,
- National Centre for Nuclear Research,
- The John Paul II Catholic University of Lublin,
- Centre for Theoretical Physics of Polish Academy of Sciences.

International Collaboration

International collaboration initiatives are coordinated and supported by the AGH UST Section for Cooperation. Of major importance are grassroots initiatives launched by AGH UST students and employees participating in international research teams.

Within the scope of international collaboration:

- The AGH UST has registered 277 general collaboration agreements (Memoranda of Understanding) entered into with a number of universities worldwide (as of the day 31.12.2019);
- The AGH UST has embarked on collaboration projects with 62 states all over the world. To date, the largest number of agreements were signed with universities in the

Ukraine (48), France (24), the People's Republic of China (20) and the United States of America (18);
- there were 539 agreement under the Erasmus+ programme and 3186 AGH UST employees went abroad in the academic year 2018/2019;
- 401 foreign visitors, chiefly from USA, the Czech Republic, Vietnam, Germany and Japan, paid a visit to the AGH UST in 2019*.

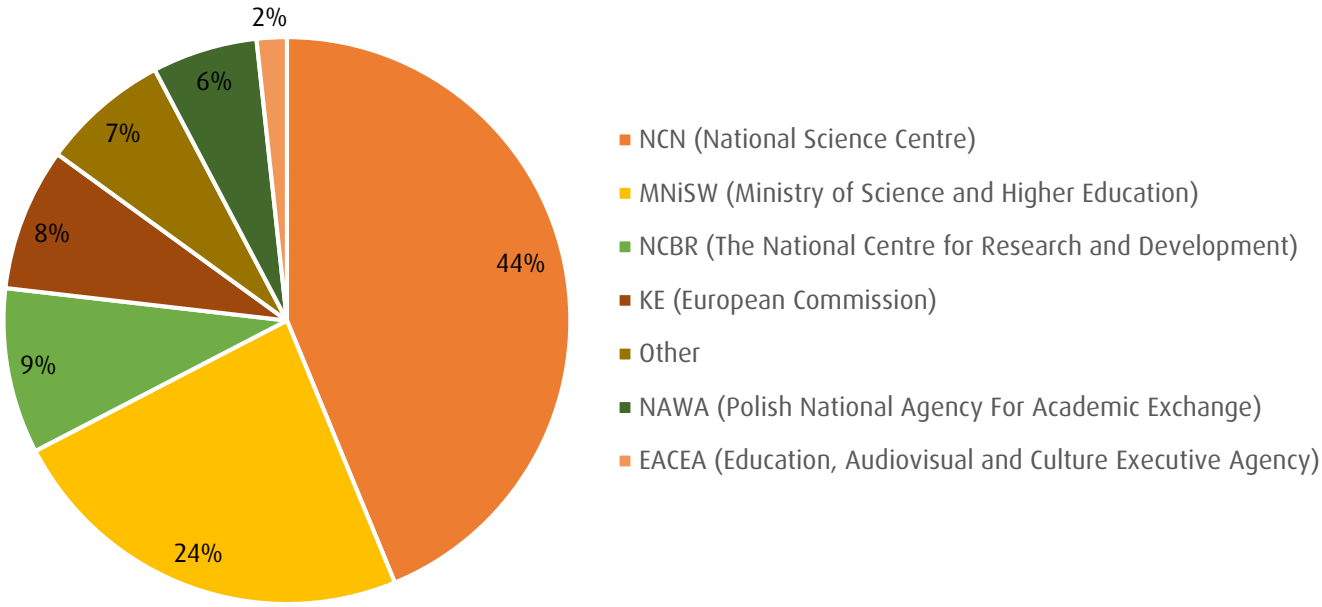
AGH UST has actively collaborated with the following international research centres:

- ACRU (Association of the Carpathian Region Universities),
- EUA (European University Association),
- IAU (International Association of Universities),
- SEFI (Société Européenne pour la Formation des Ingénieurs),
- AEUA (Arab and European Universities Association),
- KMM-VIN AISBL (European Virtual Institute on Knowledge-based Multifunctional Material AISBL),
- C-MAC NSU NPO (European Integrated Centre for the Development of New Metallic Alloys and Compounds),
- T.I.M.E. (Top Industrial Managers for Europe),
- Magalhaes Network,
- EIT InnoEnergy (Knowledge Innovation Community),
- EIT Raw Materials,
- CEEPUS (Central European Exchange Program for University Studies),
- IROs Forum (International Relations Offices Forum),
- SPIRE (Sustainable Process Industry through Resource and Energy Efficiency),
- UN Global Compact (United Nations Global Compact)**.

The scale of international collaboration is closely related to the number of external projects, financed from domestic and international sources. The majority of projects initiated in 2019 and 2020 have received subsidies from domestic sources: the National Science Centre (NCN) – 44% and the Ministry of Science and Higher Education (MNiSW) – 24% (Fig. 3). Projects financed from international sources and those undertaken within the framework of Erasmus+, Horizon 2020 an EIT Raw Materials programmes are steadily growing in importance.

* Source: *The AGH UST Rector's Report on the University's Activity in 2019.*
** Source: Department of International Relations.

Fig 3. Sources of finance for projects initiated in 2019 and 2020



Source: AGH UST sources

The authors of the Report categorised the projects initiated in 2019 and 2020 in relation to particular Sustainable Development Goals (Fig. 4).

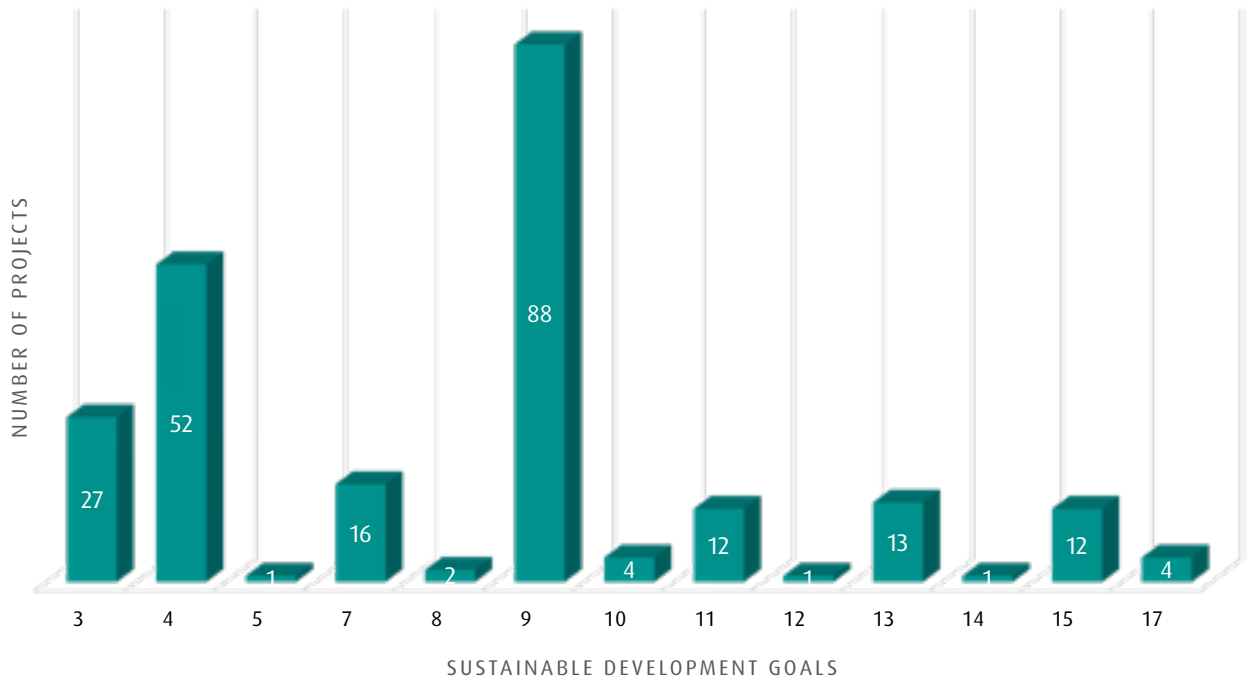
Sustainable Development Goals

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlements inclusive, safe, resilient and sustainable
12. Ensure sustainable consumption and production patterns

13 Take urgent action to combat climate change and its impacts
14 Conserve and sustainably use the oceans, seas and marine reso-urces for sustainable development
15 Protect, restore and promote sustainable use of terrestrial eco-systems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16 Promote peaceful and inclusive societies for sustainable deve-lopment, provide access to justice for all and build effective, ac-countable and inclusive institutions at all levels
17 Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: https://www.un.org/sustainabledevelopment/sustainable-development-goals

Fig 4. Projects initiated in 2019 and 2020 in the context of Sustainable Development Goals



Source: AGH UST own sources

Nearly 40% of initiated projects are aligned with Goal 9 "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation", which is a natural consequence of the fact that AGH UST is a technical university actively involved in practical implementations of projects, mostly in industrial plants. A large number of projects are aligned with Goal 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". Projects in the area of education are aimed

to improve the quality of teaching, to create new courses and trainings addressed to employees, to support development of innovative syllabuses in compliance with the Polish Qualifications Framework. The first and foremost mission of the university is to provide education, hence the projects aimed at improvement of skills and competence of both internal and external stakeholders should be regarded as top priority. Elimination of unequal opportunities and providing access to education are of major importance too, hence 12% projects pursued at the AGH UST are aligned with Goal 3 "Ensure healthy lives and promote well-being for all, at all ages".

Environmental initiatives

AGH UST has launched numerous initiatives to meet the objectives of sustainable development and to promote environment protection and circular economy principles. As an environmentally-aware part of the ecosystem, the AGH UST is committed to engaging internal and external stakeholders in a range of activities for the climate. The strategic areas are defined which are of key importance in the context of climate changes and with an eye to build the society aware of their responsibility for future generations.

Analysed areas

Fig 5. Analysed areas in the context of social responsibility

1. Costs of waste treatment and waste disposal

Responsible waste management is a key aspect of the organisation's social responsibility, bringing in good profit both for the environment and the community. The annuals costs of waste treatment and disposal borne by the AGH UST are gradually decreasing, despite an increase of charges for waste disposal (Table 9), which is largely attributable to effective management strategies and restricted access to university buildings due to the COVID-19 pandemic.

Table 8. Waste treatment and waste disposal costs in selected units of AGH UST

Year	Costs (PLN)
2019	190,550.37
2020	85,793.21

2 and 3. Investment grants brought into operation in 2019 and 2020 and investment projects supporting renewable sources of energy

The AGH UST is continually developing, new buildings are under construction whilst the existing ones are being upgraded. New buildings meet the highest technical and technological standards in the building industry, the existing buildings are modernised and adapted to ensure the compliance with statutory fire protection requirements and to improve their energy efficiency. Special efforts are made to reduce the energy consumption and rationalise the operating costs of the existing infrastructure, for example through implementation of effective BMS (building management systems).

In 2018 the multi-storey building D-8 was thermally upgraded and in 2019 and 2020 the plans were made and the applications were submitted for financing of the following thermal upgrading projects:

- Improvement of thermal performance of the AGH UST building D-13.
  The value of the investment project is 7 million PLN and financial support from the Cohesion Fund amounts to 3.7 million PLN. The scope of the upgrading works was determined following the ex-ante energy efficiency audit, and the following results are expected:
  - reduction of the final energy consumption: 2,337.22 GJ/year;
  - thermal energy savings: 2,414.00 GJ/year;
  - reduction of primary energy consumption: 1,870.81 GJ/year
  - reduction of primary energy consumption in public buildings (CI): 519,670 kWh/year;

- Improvement of energy efficiency of the AGH UST building D-11.
  The value of the investment project is 3 million PLN and the financial support from the Cohesion Fund amounts to 1.911 million PLN. The scope of the upgrading works was determined following the ex-ante energy efficiency audit, and the following results are expected:
  - Estimated annual reduction of greenhouse gas emissions (CI): 167.74 ton CO_2-equivalent
  - Reduction of final energy consumption: 1,509.55 GJ/year;
  - Thermal energy savings: 1,171.00 GJ/year;
  - Reduction of primary energy consumption: 1,953.23 GJ/year
  - Reduction of annual consumption of primary energy in public buildings (CI): 542,560 kWh/year;
  - Energy savings: 94.14 MWh/year;
- Improving the energy efficiency of the AGH UST buildings B-6 and H-B6
  The value of project is 4.85 million PLN, it is co-financed from the Cohesion Fund in the amount of 1.86 million PLN. The actual scope of the upgrading works was determined following the ex-ante energy efficiency audit, and the following results are expected:
  - Estimated annual reduction of greenhouse gas emissions (CI): 322.93 ton CO_2-equivalent
  - Reduction of final energy consumption: 3,729.47 GJ/year;
  - Electric energy savings: 195.00 MWh/year;
  - Thermal energy savings: 2,896.00 GJ/year;
  - Reduction of primary energy consumption: 3,890.61 GJ/year
  - Reduction of annual consumption of primary energy in public buildings (CI): 1,080,725.00 kWh/year;

Having received financial support from the European Regional Development Fund under the Regional Development Programme 2014–2020 for the Małopolska Province, the AGH UST successfully established the Centre for Sustainable Development and Energy Conservation in Miękinia (near Krzeszowice). The value of the project is about 19 million PLN, with the financial support amounting to 7.7 million PLN. The new laboratory complex was planned to be built and provided with the equipment and facilities requisite for research work conducted on the commercial basis. The lab complex, incorporating a building constructed to the passive design standard to ensure the maximal use of energy from renewable sources, is planned to house the following laboratories:

- Laboratory of Renewable Energy Sources, Energy and Environment Conservation complete with the heat pump laboratory;
- Laboratory of Solid Fuel-Fired Heating Systems providing the facilities for production and utilisation of solid, liquid and gaseous biofuels;
- Laboratory of hybrid systems for distributed generation;

- Laboratory of Mineral and Organic Sorbents provided with the test facility;
- Laboratory of Radioisotopic Environmental Analysis;
- Laboratory iLAb as virtual reality, complete with a computer room and a 3D multi-media room enabling the prototype development and testing of research data;
- Accredited Laboratory of Hydrogeochemistry.

The AGH UST has submitted an application for funds to finance the project involving the thermal upgrading and reduction of energy consumption in the Młoszowa Palace and Park. The project value is 14 million PLN and the co-financing in the amount of 10.7 million PLN is to be granted from domestic sources available through the National Fund for Environmental Protection and Water Management.

4. Costs of preventive measures against environmental damage and of environment protection management

On the AGH UST Campus grounds, next to the building H-B1-B2 there is now an ABB test EV charging station installed, to be used for the training purposes and for testing energy grid loading under operating conditions.

5. Total consumption of energy from renewable sources

The AGH UST uses energy from renewable sources for research and in laboratory work. For example, the building D-2 is equipped with a heat pump system supplied by the Faculty of Drilling, Oil and Gas with the following parameters:

- 2 pumps with thermal power of 30 kW each,
- 60 kW thermal power
- 15 kW of electric power,
- 14 downhole heat exchangers at a depth of 84 m.

It is estimated that approx. 30% of the building's demand for heat is thus covered. The exchanger is capable of providing both heating and cooling to the building, and in summer it is used to cool the supplied air. The system is fully metered and its operating parameters, including the performance of downhole heat exchangers, are rigorously monitored.

6. Reduction in energy consumption as a direct effect of implementation of environmental protection and energy efficiency programs

Thermal energy consumption for 2019 – 80,445 GJ,
Thermal energy consumption for 2020 – 77,632 GJ.

7. Environmental protection expenditures

In 2019 and 2020, AGH UST incurred expenditures on a number of environmental protection schemes.

The automation system in the AGH UST swimming pool was upgraded, which allowed for:

- reduction of water consumption through more effective rinsing of pool filters;
- reduction of energy consumption through improved heat recovery from dirty water;
- more effective utilization of dirty water through efficient automatic refilling of tanks with fresh water;
- using the waste heat from ventilation systems to pre-heat the water.

In the B-9 and D-2 buildings, the BMS system was installed to supervise the building automation systems. Both buildings are provided with air handling units whose efficiency is regulated by CO_2 sensors located in the rooms. In addition, the lighting installation was upgraded: new luminaires were installed that can be controlled at nighttime to save energy and reduce the "brightening of the sky" effect. Energy consumption shall be reduced by changing light sources while maintaining the light color (sodium lamps). Modern LED light sources have been positioned such as to reduce the "brightening of the sky" effect. The pilot project was carried out in the area next to the building U-1.

In 2020, the following projects were launched to reduce energy consumption:

- Design and implementation of thermal upgrading of buildings B-6, H-B6, D-11 and D-13;
- Providing photovoltaic cells in the newly-erected building C-7;
- Construction of a multifunctional sports hall equipped with a green roof and building management system (BMS).

8. Emission of greenhouse gases (including CO_2)

The university does not contribute to greenhouse gas emissions. Measurable quantities of greenhouse gases on the Campus come from the use of gas-fired boilers in buildings belonging to AGH UST and fuel combustion in cars.

9. Number of reams of paper used

Great efforts have been made to reduce the consumption of traditional information carriers. A reduction in paper consumption can be observed, though the effects registered in 2020 are clearly attributable to the COVID-19 pandemic. The number of reams of paper used was 14,990 in 2019 and 9,337 in 2020.

10 and 11. Water consumption and waste generation

In 2019 the number of employees within the area of the AGH UST Campus was 4,169, in 2020 it became 4,186. In order to obtain reliable information on water consumption and waste generation, it is required that not only AGH UST employees should be taken into account, but also other people present on the premises. When analysing data for 2020, one has to bear in mind the limited mode of the University operations due to the SARS-CoV-2 restrictions.

Water consumption in m^3 per 1 employee:

- 34.59 m^3 in 2019;
- 24.98 m^3 in 2020.

Table 9. Detailed data on water consumption in m^3 per 1 employee

AGH UST units	Volume in m^3 in 2019	Volume in m^3 in 2020
Campus	97,932	78,853
Laboratory in Regulice	102	94
Swimming Pool	19,053	9,848
Student Campus	21,457	11,566
Academic Computer Centre Cyfronet AGH	3,261	2,536
Guest house Sienkiewiczówka	355	88
Center of Energy, research and teaching sections	2,027	1,594
TOTAL	**144,187**	**104,579**

	Volume in m^3	Number of employees	Average water consumption (in m^3/ the number of employees)
2019	144,187	4,169	34.59
2020	104,579	4,186	24.98

The amount of generated waste in m^3 per 1 employee:

- 3.47 m^3 in 2019;
- 1.75 m^3 in 2020.

Table 10. Waste generation in AGH UST units in m³, per employee

AGH UST units	Volume in m³ in 2019	Volume in m³ in 2020
Campus, Swimming Pool, Guest house Sienkiewiczówka	6,222	3,351
Student Campus	8,100	3,900
Academic Computer Centre Cyfronet AGH	123	85
Laboratory in Regulice	5.76	2.88
TOTAL	**14,451**	**7,339**

	Volume in m³	Number of employees	Average waste production (in m³/ the number of employees)
2019	14,451	4,169	3.47
2020	7,339	4,186	1.75

Good practices in the area of environmental activities

As part of AGH UST activities, initiatives are promoted that fall within the scope of good practices in the field of environmental protection. There have been a number of initiatives embracing ecology, environmental protection and sustainable development, six of them are presented below.

Greenery surrounding AGH is beneficial to the bees

The AGH UST Campus can boast of large open-air green spaces.. It is located in the vicinity of the Krowodrza Park, Jordan Park and the Kraków Commons and the closeness to green open spaces prompted the decision to embark on production of honey, straight from the AGH UST. Those involved in honey production are the employees of the Faculty of Materials Engineering and Ceramics. In 2016 five bee hives were placed on top of the Faculty main building, housing over 300,000 bees. This initiative was very well received by the AGH UST stakeholders.

It is not the only site on the AGH UST Campus where beekeeping is practiced. Establishment of the Mining and Metallurgy Brewery in the academic "Studio" Club on the Campus encouraged the employees of the ACADEMICA Students' and Graduates' Association to embark on production of their own honey brand "Studio Honey". Several beehives on the grounds next to the club provide honey which is then used in manufacturing of Honey Beer, immensely popular among the members of the academic community.

Animal-friendly Campus

Each year utmost care is taken to transform the AGH UST Campus into a place where wild animals can find a quiet spot in the middle of the town. The AGH UST authorities are well disposed to all living creatures that inhabit the grounds in the vicinity of the university buildings, and so numerous initiatives and small investments on the premises contribute to the well-being of numerous species. Among such initiatives is the construction of hedgehog houses and providing bird nesting boxes and winter feeders.

AGH UST Green Roofs

Implementation of green roof solutions has both aesthetic and environmental impacts, in line with anti-smog initiatives, enabling rain water collection and boosting the energy performance of the buildings.

At first the solution was implemented on top of the AGH UST building D17 where the green roof section is grown with plants from the *Crassulaceous* family, easily adaptable to local environmental conditions. Another spectacular feature is the ivy-covered "green" wall.

The green roof solution is planned to be implemented in newly-erected sports hall in Buszka Street, Kraków, where the roof will feature a green terrace grown with honey plants, making it a friendly place for bees, butterflies, and other insects. It will also have a recreational function allowing a bird's-eye view of the beautiful city of Kraków.

Inter-departmental research team "AGH UST for the Environment"

Under the auspices of the AGH UST Rector, an inter-departmental interdisciplinary research team was launched in 2020 committed to the development of a platform enabling effective collaboration and integration of researchers and academics engaged in broadly understood environmental studies. The main aim of the research team is to facilitate the exchange of ideas relating to environmental initiatives with organisations, industry and administrative units as well as NGOs and civic movements. Among team members are academics and researchers from the Faculty of Geology, Geophysics and Environmental Protection, Faculty of Mining Surveying and Environmental Engineering, Faculty of Physics and Applied Computer Science, Faculty of Energy and Fuels and Faculty of Computer Science, Electronics and Telecommunications.

Education for the Environment

The AGH UST provides education offering courses in subjects related to environmental protection. Among courses well-tailored to needs of the labour market and enhancing the development of the "green deal" strategy are the following: Revitalisation of degraded areas (Faculty of Mining and Geoengineering); Renewable energy and energy management (Faculty of Energy and Fuels), Geoinfomation (Faculty of Mining Surveying and Environmental Engineering), Geoinformatics (Faculty of Geology, Geophysics and Environmental Protection). It is worthwhile to mention that AGH UST is one of the few technical universities in Poland offering such a broad range of modules and courses in the area of circular economy to be pursued on the 1st, 2nd and 3rd cycle studies (Faculty of Mining Surveying and Environmental Engineering, Faculty of Management, Faculty of Mining and Geoengineering, Faculty of Energy and Fuels. Educational activities in the field of environment protection are initiated by the AGH UST academic staff, they also supervise a number of projects launched by student teams: the design of an electric surfing board constructed by Igor Łukasiewicz, a Machine Design major, a photovoltaic bench on the AGH UST Campus developed by the Student Research Association "Nova Energia" (Faculty of Energy and Fuels), and a solar boat developed by the Student Research Association "Eko-Energia" (Faculty of Energy and Fuels) and Academic Sailing Club AKŻ AGH.

Collaboration with external stakeholders in the area of environment protection

The AGH UST recognises and appreciates the role of industry, administrative units and non-governmental organisations in the quest for new solutions that will be both citizen- and environment-friendly and viable. To facilitate the development of research ideas, the AGH UST has established collaboration with the following institutions:

- Municipal Heat Supply Company (MPEC) SA (under the agreement providing for collaboration in development of pilot projects exploring the potentials of cogeneration of electric and thermal energy from renewable sources);
- Azoty Group (long-term collaboration in development of technologies for the climate and environment protection);
- Małopolska-Podkarpacie Clean Energy Cluster;
- Waste Management and Recycling Cluster – a national-level cluster.

AGH UST employees actively participate in works of expert teams on the national, international and regional level (UNEP Resource Panel, European Platform of Circular Economy, Eco-Małopolska Council, the National Environment Protection Council, and the Group for Territorial Plan for Just Transition in the Małopolska Province).

Good practices at the AGH UST that implement the concept of social responsibility of the university and support sustainable development

The AGH UST undertakes a lot of activities related to the implementation of the concept of CSR, Sustainable Development Goals (SDGs) and postulates included in the University Social Responsibility Declaration. The key ones are those that take into account the needs of external and internal stakeholders.

The authors of this Report have requested representatives of the AGH UST Faculties to present key practices, initiatives and projects implemented in this area in the years 2019–2020. The described activities, apart from their value for the stakeholders, contribute to promoting socially responsible attitudes and good practices at the local, regional, national and international levels and foster strategic partnerships for the development of a sustainable future. These practices were identified and described by the originators and those responsible for their implementation, and then organized around thematic priority areas: educational, social, and environmental. Additionally, they were assigned to:

- Sustainable Development Goals (SDG);
- University's social responsibility principles (USR).

Together with the already described activities carried out at the central university level, this approach allows for a comprehensive and horizontal presentation of the activities and implemented solutions.

The authors wish to express their sincere thanks to the AGH UST academic community for their commitment and involvement in the work of presenting the good practices developed through this Report.

Faculty	Name of practice	Description of practice	SDG	USR
		Environmental practices		
WFiIS	Identification of the sources of coal aerosols in the Krakow agglomeration based on an analysis of the chemical and isotopic composition of PM10 and PM1 fractions of suspended dust	Krakow is among the most polluted urban centres in Poland. The poor state of air in Poland and worldwide has stimulated researchers to attempt to better understand the parameters affecting air quality in urban environments: the sources of dust and gaseous pollutants, the spatial and temporal variability of their emissions, and the influence of urban atmospheric dynamics on the observed atmospheric aerosol load. The research work is focused on an in-depth characterization of the carbon fraction of atmospheric aerosols in the Krakow agglomeration. The comprehensive characterization of the aerosol carbon fraction includes chemical (elemental carbon, organic carbon, polycyclic aromatic hydrocarbons, carbohydrates) and isotopic (13C/12C and 14C/12C isotope ratios) analyses of the carbon reservoir in particulate matter.	13, 11	10
WFiIS	Mobile measurements of methane and carbon dioxide in the area of Katowice city – project conducted for SRK Katowice	The project commissioned by the Company Spółka Restrukturyzacji Kopalń (SRK), in which the Environmental Physics Group of the Faculty of Physics and Applied Computer Science has undertaken to conduct mobile measurements of methane and carbon dioxide in the area of Katowice city, especially in the areas of inactive coal mine shafts.	13, 11	10
WFiIS	Participation in the Project CCAC 1	The project financed by the United Nations Organisation in the framework of the strategic action plan of CCAC (Climate and Clean Air Coalition) and EDF (Environmental Defense Funds). Its purpose is to determine the release of methane from gas pipelines of all pressures, reduction and measurement stations, natural gas reservoirs and natural gas production sites in southern Poland. Mobile measurements are performed using a vehicle equipped with a methane analyser, ultrasonic wind meter and GPS recorder.	13	7
WFiIS	Hydrogen – the fuel of the future? The design of a hydrogen reservoir and hydrogen-powered boat	The project is the continuation of the work that consisted in the design of a self-composing hydrogen tank based on the active material LaNi5, and the design of a simple hydrogen-powered boat. A new reservoir based on the material called Hydralloy C has been designed. The reservoir design incorporated two innovative solutions to significantly increase its capacity. Moreover, a number of laboratory tests of the Hydralloy C material were carried out (X-ray diffraction (XRD), fluorescence analysis (XRF) and sorption measurements) to study the reaction kinetics and accurately determine the performance of the constructed reservoir. According to the obtained results of the sorption tests, the weight concentration of hydrogen in the new reservoir is high and highly satisfactory. It indicates a high application potential of this design method for hydrogen storage in the future. The boat has also been improved by being equipped with a remote control module, and also due to the incorporation of an improved pressure regulator, the boat's performance has been significantly increased.	7	10

Faculty	Name of practice	Description of practice	SDG	USR
		Environmental practices		
WIEiT	Air monitoring	As part of the activities undertaken by the Chair of Computer Science, an inter-faculty group of researchers interested in broadly understood climate monitoring has been set up. It prepares offers for industry and non-governmental organisations related to services that can be provided by the AGH UST. A network of low-cost air pollution sensors has been deployed at the AGH UST campus.	13	10
WIEiT	Computer simulations of the impact of deposit extraction on groundwater contamination	The aim of the undertaken research was to carry out computer simulations of the impact of crude oil or natural gas deposit extraction on groundwater contamination. The 3-D isogeometric finite elements method was used to simulate hydraulic fracturing and its influence on groundwater contamination. Moreover, using multi-criteria optimization methods, the optimum location of wells was determined to maximize production while minimizing groundwater contamination.	13	10
WIEiT	Stimulating the emergence and development of energy clusters	The primary objective are activities in the field of providing the energy security of the country while simultaneously controlling pollution emissions. It requires a synergistic combination of large-scale with distributed power engineering, based on a rational use of local energy sources and the activity of energy clusters, which should result in reducing the rate of climate change. An appropriate mix of renewable and other energy sources within energy clusters can locally ensure energy self-sufficiency and stimulate the reduction of the level of pollution in the surroundings of a cluster. The issue of low emissions, to a large extent caused by inefficient combustion of poor quality fuels in domestic boilers and furnaces can be effectively curbed thanks to the development of energy clusters based on "clean" energy sources and technologies. To this end, it is very promising to develop organizational and technical solutions dedicated to supporting cluster management and stimulating cluster development.	7	10
WEAIiIB	The project entitled "Development of distributed energy in energy clusters (KlastER)"	The aim of the project is to elaborate strategies for the development of energy clusters in Poland on the basis of a wide range of conducted analyses and a pilot launch of clusters using the developed technological and organizational solutions. To this end, a new research unit has been established, i.e. Competence Network for Distributed Power Engineering. The scope of its activity will include diagnosing social, organisational, legislative, technical and ecological problems, as well as seeking and making recommendations on how to solve them. The implementation of project outcomes will accelerate the development of distributed energy in energy clusters, thus contributing to economic and social development.	7	11

Faculty	Name of practice	Description of practice	SDG	USR
		Environmental practices		
WEAIiIB	The project entitled "Distributed generation and load flexibility in industry (ERANET RELflex)"	The aim of the RELflex project is to develop, test and evaluate new innovative solutions and applications for increasing the flexibility of energy-relevant industry processes at SMEs by developing and studying mechanisms for the dynamic management of controllable loads, generation systems, including renewable energy sources, and energy storage facilities. The project will develop methods, algorithms, and business model concepts for various applications of dynamic demand side management (DSM) and demand side response (DSR) systems in industrial processes. A demonstrator pilot installation will be built to test the elaborated methods, algorithms and models with the focus on developing clear guidelines for the organisation of the so-called "virtual power plants". It is also planned to modernize the energy infrastructure of selected industrial entities where elements of the demonstrator pilot installation will located.	7	10
WGiG	LIMBRA. Decreasing Negative Outcomes of Brain Drain in the Raw Materials Sector	LIMBRA is a project funded by EIT Raw Materials Project (KIC) and its main aim is to enhance entrepreneurship. The task of this learning project is to develop multi-level solutions to reduce the so-called brain drain in the raw materials sector, inter alia through SME development training and other events aimed at improving the knowledge of graduate engineers in the field of entrepreneurship with a particular focus on the special needs of the Y and Z generations and the changing demand for skills.	13	4
WGiG	EnAct-SDG Enhancing the skills of ESEE RM students towards the achivement of SDGs	EnAct-SDG is a two-year project that enhances the skills of students in the raw materials sector in the ESEE (East and South East Europe) countries in terms of implementing and achieving Sustainable Development Goals (SDGs). Its main tasks include: developing a dynamic, self-sustaining ecosystem and network for collaboration between academia, researchers, industry and professionals from the raw materials sector and elaborating an action plan that will stimulate the implementation of basic assumptions such as modernizing educational practices, integrating sustainable development principles into the educational programmes of ESEE universities, as well as enhancing the skills and competencies of graduates and professionals in the raw materials sector. The project is implemented by eight partners under EIT Raw Materials. Additionally, it is supported by two industrial RIS partners: the Polish Copper Employers' Association (Poland) and the National Technology Platform for Research, Development and Innovation of Raw Material (Slovakia).	4	4

Faculty	Name of practice	Description of practice	SDG	USR
		Environmental practices		
WGiG	MOBI-US: structured mobilities for ESEE raw materials master program	The project financed by EIT Raw Materials is aimed at broadening the offer of degree courses related to raw materials in the ESEE region using student learning mobility. The mobility network works on the basis of the existing curricula, which have been verified in practice because they are based on decades of teaching experience. Instead of creating new joint educational programmes, we are improving the existing ones. The collaboration between partner institutions provides the opportunity to add a new optional specialization (that is not currently offered or sufficiently well prepared) to the original programme, thus broadening the educational offer of the participant's country. The newly created network of master degree courses will enable students to complete one semester of their studies at a partner university. Studying at a partner university in a specialization that is closely related to that studied at the home institution will be possible thanks to the so-called "mobility window". Project partners: the University of Miskolc (Hungary), the University of Zagreb (Croatia), the Wrocław University of Science and Technology (Poland)	4	4
WGiG	Analyses of lightweight aggregates based on waste materials – the onset of changes on the Polish aggregates market	In 2019, the Student Research Associations "Zarządzanie" and "Separator" began collaboration with z Bioeko (Tauron Group; one of the companies belonging to the power industry holding TAURON). Its material result was the implementation of the project entitled "An analysis of the Lightweight Artificial Aggregates Market in Poland in the Years 2019–2020". Its aim was to identify the market benchmarks in the area of lightweight aggregates based on mining and/or metallurgical waste materials that for a particular company could become an element in the development of new technologies in this field, thus serving the idea of circular economy. The final part of this project was a presentation of its results to the company's Board of Directors in July 2020.	4	10
WGiG	Green concrete as a modern material for sustainable development	Under the AGH UST Rector's Grant in 2020, the Student Research Association of Civil Engineering and Geomechanics undertook the project entitled: "Green concrete as a modern material on the Polish construction market". This project became one of the directions of scientific and research deliberations aimed at finding ecological material solutions allowing for the reduction of cement and filler consumption in concrete, thus becoming one of the elements of the implementation of sustainable development activities in the construction industry.	13	10
WGiG	Biological enrichment of post-flotation waste using fungi – an idea for reducing mining waste	Under the AGH UST Rector's Grant awarded in the 2018 edition, the Student Research Association "Separator" implemented the project entitled "Biological enrichment of post-flotation waste using native and allochthonous species of microscopic fungi". One of the main objectives of this research was to test the feasibility of using these living organisms to recover precious metals from former post-flotation dumps, allowing to reduce their negative impact on the environment. The project demonstrated the feasibility of this method, both under laboratory and semi-industrial conditions, thus becoming an interesting contribution to the future development of this technology.	13	10

Faculty	Name of practice	Description of practice	SDG	USR
		Environmental practices		
WGiG	The utilization of waste in underground mining technologies	Under the AGH UST Rector's Grant awarded in the 2018 edition, students of the Faculty of Mining and Geoengineering, members of the Student Research Associations "Ekospirit" and "Filar", implemented the project entitled "The utilization of waste in underground mining technologies" in 2019. Laboratory tests were conducted using samples taken in situ, which allowed to determine the use of mining waste in the following processes: backfilling of mine workings and backfill-strip mining, construction of anti-explosion dams, sealing of caved goafs and shotcreting. The aim of the project was to show the advantages of taking this direction of post-mining waste management, as well as to analyze the impact of underground waste management on the environment. The project determined what parameters (the compressibility, water permeability and grain-size distribution of backfill materials based on waste) must be kept so as to enable using mining waste in mining operations as support materials.	13	7
WIMiIP	Student Research Association "Caloria" activity	Members of the "Caloria" Student Research Association conduct research in growing various strains of algae. The growth of algae takes place through the supply of carbon dioxide and nutrients. Currently, carbon dioxide is supplied from cylinders, while on a larger scale it is possible to use it from those industries where it is produced in large quantities. Owing to this, activities in the area of growing algae can contribute to reducing greenhouse gases emissions. The obtained algae are used to produce 3rd generation biofuels, among others biodiesel. The activity of the "Caloria" Student Research Association also includes producing biodiesel from expired and residual cooking oils. The technology of biodiesel production from fat waste and algae reduces petroleum consumption and solves the problem of fat waste management, whereas algae farming additionally enables the utilization of carbon dioxide.	13	10
WGGiIŚ	The invention of an innovative technology for producing water with reduced redox potential	The method for producing water with reduced redox potential was reported as know-how to the AGH UST Centre for Transfer of Technologies The technology was thoroughly tested within the project "RedWater – An innovative Technology for Producing Water with Reduced Redox Potential" conducted under the project "Innovation Incubator +", funded by the Ministry of Science and Higher Education. Currently, talks are underway with InnoAGH to commercialize this idea. The core element of the solution is the method of lowering the redox potential in water intended for consumption using a reducing substrate. Reducing the redox potential in water makes it a dietary supplement with medicinal properties or one that can be used for health prevention. The innovativeness of this method lies in using filtration for producing water with reduced redox potential on a special substrate. The application of this solution enables cheap and fast production of hydrogen, which immediately dissolves in the filtered water.	4	7

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WEAIiIB	A nurse scheduling system in a pre-adoption center	As part of collaboration between two Student Research Associations, "Glider" and "AI Lab", a system supporting the work of the Pre-Adoption Intervention Centre run by the Adoptive Families Foundation is being created. Its purpose is to streamline facility operations by making it easier to create the schedules of nurses and caretakers. The application automatically checks the compliance of schedules with legal requirements while taking into account employee preferences. In addition, the system enables creating the documentation of the center's work needed to report on the activities of the foundation. The programming work is expected to be completed in 2021. If the project is successfully implemented, it is planned to adjust the tool to the needs of other caretaking facilities.	9	6
WIEiT	PharmOptim	The project involves the development of the system enabling the simulation of the pharmacokinetics of antazoline prior to administering the drug to a patient with cardiac problems. The implementation is carried out based on the AGH UST infrastructure, i.e. ACC Cyfronet. The project is non-commercial. The project represents the area of personalized medicine.	3	6
WIEiT	Girls Go Cyber	A training course financed by Motorola and implemented by the AGH UST scientists, addressed to women in order to eliminate the shortage of female employees in the IT sector. Women who want to change their career path can try their hand in the field of Cyber Security.	5	3
WIEiT	Introduction to AI and Data Science	A training course financed by Motorola and implemented by the AGH UST scientists, addressed to women in order to eliminate the shortage of female employees in the IT sector. Women who want to change their career path can try their hand in the field of AI and Data Science.	5	3
WIEiT	Digital Innovation Hub	The AGH UST participates in the Digital Innovation Hub project, under which it offers expertise and training to companies to enable them to grow in the area of Cyber Security and AI.	9	12
WIEiT	Projects in the area of Security and Defence	A number of research and development projects are being conducted at the Chair of Computer Science (AGH UST) within the framework of Security and Defense competitions organized by the National Centre for Research and Development. The outcomes of these projects are prepared for implementation in institutions dealing with public safety. Especially worth mentioning is the LINK project used by thousands of users across the country.	9	6
WIEiT	A new course of study: Cyber Security	In 2019 at the AGH UST, a new course of study, Cyber Security, was launched, profiled to fill the gap in the labour market, which reports a high demand for professionals in this field. This degree course is taught mainly by the staff of the Chair of Computer Science and the Chair of Telecommunications (AGH UST).	16	4

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WIEiT	A new course of study: Modern Technologies in Forensic Science	In 2019, a new course of study, Modern Technologies in Forensic Science, was launched. This degree course aims to educate interdisciplinary specialists in the field of IT who will acquire the knowledge necessary to work with public safety institutions in the area of forensic science or crime analysis.	16	4
WIEiT	Postgraduate studies "Cyber Security in Practice"	The educational offer of postgraduate studies "Cyber Security in Practice " is addressed to all those wishing to deepen their knowledge of the management and administration of computer systems security. Due to the specific character of this topic, the focus is on acquiring the skills to be able to conduct practical tasks in this area. The goal of these studies is to prepare graduates to take up professional activity related to cyber security. The curriculum includes 200 hours of lectures and laboratory classes.	16	4
WIEiT	Implementation of the Project "Lemkin – intelligent legal information system"	Lemkin is one of legal information systems. Lawyers use legal information systems to prepare legal opinions and pleadings. These systems make it possible to search for relevant court decisions on the basis of the quoted provisions and keywords. The innovative character of this project lies in significantly facilitating the search for particular provisions and decisions, especially for those who have not received any training in the legal profession. It is accomplished by means of a communication interface that allows questions to be asked in Polish. This considerably reduces the cost of access to legal knowledge, especially in the case of simple, repetitive legal issues. It contributes to facilitating access to fair adjudication both in the courts and in government offices.	16	5
WIEiT	Małopolska Education Cloud	The aim of this project is to launch the e-service that consists in providing tools and resources to carry out the educational process (lectures, seminars, laboratory classes, running special interest clubs, etc.) both in the on-line and off-line mode at the interface between secondary schools and universities. The project includes all the interested schools in Malopolskie Voivodship, major universities in Krakow (AGH UST, Jagiellonian University, Cracow University of Technology, Pedagogical University of Krakow, Cracow University of Economics and University of Agriculture), as well as selected pedagogical libraries and the Małopolska Teacher Training Centre (MCDN). The project is implemented under the sub-measure 2.1.3 of the Regional Operational Programme of Malopolskie Voivodship.	4	5
WGiG	Dubrovnik International ESEE Mining School	"TrainESEE V.2 Training Trainers in East and Soutestern Europe" is a project implemented as collaboration between six universities from East and South-East Europe, with a focus on improving specific generic skills in line with the curricula inefficiencies identified as a result of the implementation of the pilot project "Train ESEE" (2017–2018). The duration of the project was 2 years, during which four training modules were developed, implemented and prepared as accelerator programs: teaching methodology, project development and management, innovation and entrepreneurship module, and Science to Business.	13	4

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WGiG	Competent Student on the Job Market	The main objective of the project "Competent Student on the Job Market" is to improve the competencies of project participants with respect to professional, communication, analytical and design skills. The project is aimed at second-cycle full-time students of the Faculty of Mining and Geoengineering at the AGH University of Science and Technology, studying Environmental Engineering and Civil Engineering, before they start their professional careers. Dynamically developing economy and economic progress impose increased demand for educated engineering staff. Therefore, there is a need to increase professional opportunities of the Faculty of Mining and Geoengineering AGH UST students on the labour market. Due to the small percentage of females studying technical majors, it is necessary to particularly encourage them to acquire additional professional and communication skills. Direct contact of students with companies, employers, entrepreneurs and modern technologies will help them improve their competencies so that they suit the real needs of the labor market. It will also enable students to understand the practical aspects of the functioning of a particular industrial sector, which will make it significantly easier for them to start professional careers. Students will get acquainted with the current needs and requirements of employers, will considerably improve their professional competencies and skills and will be prepared to solve project problems indicated by employers or industry professionals. Certificates and certification will contribute to increased competitiveness at the beginning of their careers. Being skilled in operating and using specialized industry programs will contribute to streamlining and increasing efficiency in future work. Due to team work on projects, students will gain problem-solving skills. The project will enhance the profile of a graduate of the Faculty of Mining and Geoengineering as well-qualified, with practical knowledge and skills that meet the needs of employers.	4	5
WGiG	PROM Programme – International scholarship exchange of PhD candidates and academic staff	The project is aimed at increasing the competencies of PhD candidates and academic staff from the AGH UST and partner institutions, including those from outside the EU, by means of international scholarship exchange. The project supports the following forms of activity: active participation in foreign scientific conferences by delivering a paper, participating in a poster session or flash talk; participation in short forms of education (lasting from 5 to 30 days); participation in a summer/winter school as a participant or instructor; conducting research and carrying out measurements with the use of unique equipment which is unavailable in Poland. The project has contributed to the improvement of accessibility of international education programmes and will increase the mobility of the personnel both in the field of visits of representatives of Polish universities and scientific institutions abroad as well as arrivals of scholarship holders to Poland, including people from outside the EU.	4	7

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WGiG	Joint Social Initiatives Group "GÓRNICTWO OK"	Joint Social Initiatives Group "GÓRNICTWO OK" was established in 2016 in colaboration with the Faculty of Mining and Geoengineering. It is a think tank whose main objective is to build and conduct a common, effective policy of social support for mining as a responsible, modern, strategically needed industry. The accomplishment of this goal has been spread over a number of specific objectives, which are: • initiating, promoting and implementing CSR methods and tools in the industry, • exchange of good CSR practices between companies from this sector, • building joint CSR initiatives and projects in industry, • construction and implementation of a common and effective CSR policy for the mining industry, as a modern industry that is strategically needed in Poland and Europe. Within the scope of the activities implemented under the above objectives, in 2018–2020, "GÓRNICTWO OK", among other things: organised a series of conferences Social PreCOP24, participated in the World Climate Summit COP24 in Katowice, participated in numerous conferences on CSR and mining industry activities, and held fourteen working meetings.	4	7
WGiG	Responsible Business Conference	The Responsible Business Conference was organised within the scope of the activity of the Student Research Association "Zarządzanie" in response to the need of AGH UST students for methodical and practical knowledge in the field of social responsibility and to familiarize them with CSR issues and activities. The event includes an open lecture part, during which students have the opportunity to listen to lectures on socially responsible projects carried out by the best companies and other organizational units, as well as to take part in certification training, conducted by CSR specialists. In the years 2018–2020, three next editions of this event were held, attended by 200 participants in total. Moreover, as a result of the Responsible Business Conference a portal www.odpowiedzialny.com was launched that deals with promoting CSR activities and good practices related to them among students.	4	5

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WGiG	Lean Manufacturing – towards the elimination of waste	The Lean Manufacturing specialization was launched by the Department of Engineering and Management of Industrial Processes at the Faculty of Mining and Geoengineering in 2018, in response to the growing demand from the business community as well as students as regarding the lean management of business processes, mainly in manufacturing. In this specialization, students learn how to search for, discover, and name waste that reveals in the eight basic elements of waste. These largely involve elements related to the inappropriate use of resources, including those that make up both the natural and human capital. Based on this knowledge, they proceed to study the ways to eliminate this waste by employing the just-in-time and Jidoka principles. These principles are built through the construction and development of a motivation system for operational employees that is created on the basis of the idea of teamwork and looking for small optimization steps. Thanks to the above, the graduate of this specialization is prepared to handle production processes realized in accordance with the concept of sustainable development.	4	4
WGiG	Rescuing the monuments of Kamieniec Podolski – for the sake of industry's responsibility for cultural heritage	In 2019, three Student Research Associations, i.e. Civil Engineering and Geomechanics Research Association, "Dahlta" and "Zarządzanie", acting under the joint supervision of Associate Professor Paweł Bogacz, implemented the project entitled "Construction, urban planning and tourist value assessment of the buildings and grounds of the Pauline Order Monastery in Kamieniec Podolski aimed at creating a concept for the establishment of a meeting center for the Polish community". It was part of corporate social responsibility activities carried out by the Polish Mining Group (PGG), which saves Polish monuments abroad. As part of the project, the Civil Engineering and Geomechanics Research Association evaluated the technical condition of buildings and defined the list and technology of the most urgent protective construction works to be performed. The "Dahlta" Surveyors' Research Association assessed the extent of building subsidence, described the geometry of the buildings, and made 3D models of the main historic rooms for further conservation works. The task of the "Zarządzanie" Research Association, in turn, was to carry out an inventory and prepare an inventory report on individual rooms in the monastery complex, and on this basis to develop a concept of the religious and tourist use of all buildings.	11	2

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WGiG	We teach Corporate Social Responsibility	In 2017, the course "Corporate Social Responsibility" was launched as part of elective courses for the Department of Engineering and Management of Industrial Processes. During this course, students learn the principles of CSR and sustainable development, as well as macro- and microeconomic contexts of their implementation and the algorithm of implementing these principles in the practice of both the operations and reporting of enterprises. Within three years, it won the recognition of the student fraternity at the Faculty of Mining and Geoengineering. Among other things, due to this, since the academic year 2019/2020 it has been one of the elective subjects for students of all majors offered by the Faculty of Mining and Geoengineering, as one of the humanities and social sciences courses. Its English-language version is taught as part of the Mining Engineering course for international students.	4	4
WIEiT	Postgraduate Studies in Software Development Methods	Postgraduate Studies in Software Development Methods are a two-semester course including 240 teaching hours. The studies are dedicated to those who would like to upgrade their qualifications in the field of software development. This will be of particular importance in the situation of a dynamically changing job market and rapid development of new technologies. As a result, studies can open the way for such people to new, better paid positions on the market. The acquired experience will enable graduates to further pursue their preferences, to focus on their chosen role(s) as a software developer, and to consciously design their career around subsequent specialist courses. Graduates have a chance to actively participate in IT projects, e.g. as junior programmers, testers, analysts or project coordinators.	9	4
WEAIiIB	Employee participation in the Board of Experts of the Corporate Digital Responsibility (CDR) Programme	Since 2019, Faculty employees have been participating in the Board of Experts of the Corporate Digital Responsibility (CDR) Programme, whose goal is to: 1. elaborate studies and reports on Polish people's concerns about automation and the widespread deployment of artificial intelligence. 2. identify the areas in which CDR should be implemented and engage in dialogue with employers to incorporate CDR principles into corporate policies. 3. elaborate good CDR practices with the help of experts from many environments responsible for the development of technologies and their promotion, and award companies and institutions that positively distinguish themselves in this field. 4. communicate opportunities and risks associated with technological developments that should be covered by CDR regulations.	9	2
WIMiIP	Student Research Association "Powierzchnia" activity	The implementation of the project "Discovering properties of coatings with the 'Powierzchnia' Student Research Association", financed under the AGH UST Rector's Grant (1.01–15.10.2019). The objective of this project was to promote science among children through demonstration lessons aimed at familarizing children and young people with phenomena such as hydrophobicity and corrosion.	4	7

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WIMiIP	Supporting people with disabilities with low-cost project developed by Student Research Association "CREATIVE"	Within the scope of this undertaking, a low-budget prototype of a two-wheel wheelchair moving on the principle of an inverted pendulum was constructed. This project was entirely designed and executed by students. Several tools for the rehabilitation of children with disabilities were developed, e.g. games to support the process of motor therapy, which are currently used in a center for children with disabilities.	3	6
WIMiR	Design of a device for muscle stimulation and spinal rehabilitation	The project concerns a new computer-controlled device for suspension rehabilitation. Only simple, manually operated devices consisting of straps, ropes and pulleys are commercially available. The invention proposes replacing the pulleys with mechanical ascenders whose horizontal position (2D) over the patient's bed and operation are computer controlled. Thus conducted medical procedures are convenient and safe and require only a slight elevation of the patient above the bed, allowing patients to exercise without having to counteract their own body weight.	3	6
WIMiR	"Multisensory UNESCO 4. Digitalization of the cultural heritage of Krakow inscribed on the UNESCO list" 2020	In 2020, within the framework of the 4th edition of the project, Krakow's cultural heritage, i.e. the Cloth Hall and Florian Gate with its nearby walls and towers and the Barbican, was digitalized. The project involved a complex conversion of tangible resources into digital form by making advanced 3D models of objects. Sound tests were also carried out. The project was also addressed to people with disabilities by creating texts and recordings in the form of audio description. The results of these works have been made available free of charge to the public at www.dgitalunesco.pl both in Polish and English.	3	6
WIMiR	"Multisensory UNESCO 3. Digitalization of 8 wooden orthodox churches in the Polish Carpathian region inscribed on the UNESCO list" – 2019	In 2019, the digitization of the tangible and intangible heritage of 8 wooden orthodox churches in: Brunary Wyżne, Chotyniec, Kwiatoń, Owczary, Powroźnik, Radruż, Smolnik, and Turzańsk, was carried out to commemorate the 5th anniversary of inscribing these wooden orthodox churches in the Polish Carpathian region on the UNESCO World Heritage List. The project consisted in a complex conversion of tangible resources into digital form by making advanced 3D models of objects and their equipment. The results of these works are made available free of charge to the public. An educational event and a conference were organized. The project ensures that the digital content is distributed and made available in an open and reusable way and that new digital services can be created based on it. Digitalized data are an invaluable source of information on architectural objects and it will be possible to use them in the future for the purposes of the reconstruction or restoration of a monument destroyed as a result of natural or human activity. As part of the project, activities related to the preparation of the textt and audio in the form of audio description were also implemented in order to ensure the accessibility of the digitally presented content for people with disabilities.	3	6

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WZ	The ARTCademy project – Academy of Traditional Arts and Crafts	The project is concerned with the preservation and supporting European traditional arts and crafts on two levels: • by preserving and protecting knowledge about traditional jobs, especially those threatened with disappearance; • by providing the tools and improving the skills of the sector's workforce necessary for their survival and growth as viable businesses. Under the project, the following were launched: • a platform uniting craftsmen from several European countries; • a European virtual encyclopaedia of traditional arts and crafts, containing knowledge of craft techniques, traditional handicrafts and trade, • business training package addressed to craft enterprises; the package included 4 main modules (12 training courses) related to the needs of craft enterprises, connected with legal and organizational aspects of running a company, business strategies and models, digital competence development and improvement of managerial competences.	5	7
WZ	RMTechFlow – Capacity Building for Advanced Raw Materials Tech Transfer Deal Flow, EIT Raw Materials	The project was implemented within the framework of EIT Raw Materials. Its objective was to provide representatives of universities and research centres belonging to KIC Raw Materials with knowledge on developing and positioning technologies towards sustainable development, according to particular industry needs. Moreover, training courses for employees of technology transfer offices and innovation management agencies were conducted. The project leader was Hub Innovazione Trentino, and its partners – the AGH UST, FLS Smith, LTU Business AB, Tecnalia Ventures and Trinity College.	17	7
WZ	RMsManager	PThe project is implemented within the framework of EIT Raw Materials. Its objective to create an exchange platform for good practices in the field of higher education as regards natural resources management. The teaching activities and their scope were selected on the basis of surveys conducted among representatives of industry and science. As a result, over 200 students of technical faculties received training, among others, in the areas of sustainable development, corporate social responsibility, human capital management, circular economy. The project leader is the AGH University of Science and Technology, and the project partners include both academic and research units from Italy, Spain, Finland, Greece, Ukraine, Poland and Slovakia.	4	4

Faculty	Name of practice	Description of practice	SDG	USR
	Social practices			
WZ	The conference "Innovative ideas of young scientists: Science – Startup – Industry"	Two Student Research Associations, "Projekt Doktor" and "Ekonomia", in collaboration with IATI (Instytut Autostrada Technologii i Innowacji) are co-organising the annual conference for young researchers, PhD candidates, representatives of start-ups and students, during which innovative product, process, social, organizational, marketing and environmental solutions are presented. The aim of the conference is to promote innovative solutions, developed to a large extent by young scientists, PhD candidates and students. The conference supports their development, among others, by publishing abstracts as well as papers in various journals and monographs.	4	7
WEiP	Educational activities for children, young people and teachers in the field of energy technologies, environmental protection, electrochemical energy sources within the framework of the Academy of Young Power Engineers in Niedzica.	The undertaking involved the preparation of lectures for primary and middle school pupils as well as providing substantive support for teachers and local government officials (e.g. "Poranek z Naukowcami" in Niedzica). A similar initiative was addressed to schools in the Prądnik Valley area.	4	7
WEiP	Taming Chemistry! Scientific meetings with children and teenagers from Krakow and its suburbs / Student Research Association "Indygo"	The Student Research Association "Indygo" organized chemical demonstrations for children, aimed at arousing children and teenager's interest in science. This event, during which chemical curiosities and experiments were presented and many aspects of science were discussed, was attended by more than 2000 children from the Małopolska region.	4	7
WEiP	Laboratory activities for primary and secondary school students	For primary schools, laboratory activities are organized in the form of presentations of experiments. Secondary school students work in teams of several people on chemical exercises previously agreed upon with teachers.	4	7

Faculty	Name of practice	Description of practice	SDG	USR
	Economic/technical/innovative practices			
WMN	Implementation of innovative technologies for the railroad industry	The Faculty of Non-Ferrous Metals at the AGH UST has been developing new technologies and components for modern rail transport in cooperation with industrial partners for years. Its assets include research laboratories and experienced staff, which guarantees success. In recent years, many new material and construction solutions have been implemented in the Polish catenary networks, which contributes to the continuous improvement of the comfort and reliability of the traction vehicles on the railroad routes. The solutions developed at the Faculty and implemented into production by industrial partners include: a new generation of load-bearing and conductive equipment (Kuca Sp. z o.o.), new generation poles (ZMTK Paterek S.A.), aluminium suspensions and weightless tensioning devices (MABO Sp. z o.o.), new generation contact strips for pantographs (Carb-Graf Sp. o.o.). Railroads influence, among other things, the mobility of the society, the emergence of smart cities and the comfort of social life.	9	7
WIEiT	Computer simulations of pollutants propagation in the surroundings of Krakow	Software for conducting 3-D simulations of pollutants propagation has been developed using the finite elements method. Specifically, a parallel computer simulation of pollutant propagation in the surroundings of Krakow was carried out based on topographic data. This topic is the subject of the doctoral thesis of Krzysztof Podsiadło, MSc. A publication (in review) has been prepared for the journal "Engineering with Computers" from the Philadelphia List, in collaboration with scientists from Spain and the USA.	13	10
WIEiT	Personalized computer simulation of cancer growth	Software for conducting 3-D simulations of cancer growth on the basis of medical measurements (three-dimensional images of tumor shape) has been developed. The project was implemented under OPUS grant no 2016/21/B/ST6/01539. A publication has been prepared for the Philadelphia List.	3	6
WIEiT	Sano – Centre for Individualized Computational Medicine	In Krakow, a new research unit is being established. It is Sano – Centre for Individualized Computational Medicine. Sano's research programme includes: in-silico techniques in medicine, modeling and simulation, computer methods in medicine, data science – data analysis and artificial intelligence, large-scale computing, decision support systems. Sano's mission is: • to develop new computational methods, algorithms, models and technologies related to personalized medicine, • to introduce new diagnostic and therapeutic solutions based on computer simulations into everyday healthcare practice, • to stimulate the establishment and development of enterprises that develop technologies enabling the introduction of new diagnostic and therapeutic methods, • to contribute to the creation of new education programmes for modern, personalized medicine.	4	6

Wydział	Nazwa praktyki	Opis praktyki	SDG	USR
	Economic/technical/innovative practices			
WFiIS	Development of physical methods for the needs of medical diagnosis and therapy	The undertaken activities are aimed at supporting healthcare institutions, mainly in terms of quality assurance and control. The conducted works are multidirectional respond to the current needs of the cooperating institutions (e.g. "Amethyst" Radiotherapy Center, Radiotherapy Department of University Children's Hospital, Nuclear Medicine Department of the Military Clinical Hospital No.5 in Krakow). So far, three phantoms (Dynamic Heart Phantom, Dosimetry Phantom, and Multimodal Heart Phantom) have been designed, fabricated, and patented. These devices are made available to hospitals for medical device quality control procedures. In the field of radiotherapy, treatment plans are analyzed to identify the least burdensome procedure for the patient, e.g. the radiation procedure for breast cancer patients using the deep inspiration breath hold technique and the free-breathing procedure (DIBH or FB). Moreover, ongoing work aims to optimize the dose measurement protocol using thermoluminescent detectors (TLD).	3	11
WGiG	SmartHub – smart courier field data IoT radio network & big data analytics	"SmartHub – smart courier field data IoT radio network & big data analytics" is a project implemented within the framework of EIT Raw Materials. Its principal objective is to create an IoT platform for managing sensor data and their visualization for mining companies. The project consists in combining various data sources, advanced sensor data analytics and dedicated applications in order to optimize the functioning of mining companies with particular emphasis on their resources. The detailed objectives of the project include the use of the collected data in mining plants to: optimize maintenance, improve operational efficiency, support occupational safety management.	9	7
WIEiT	Developing platforms for building IoT systems	Under the Lider project funded by the National Centre for Research and Development (NCBR), the platform FogDevices has been developed. It is used for the construction of IoT devices allowing for the implementation of advanced systems using artificial intelligence in the field of industrial equipment diagnostics, environmental monitoring and other systems for a modern economy. The FogDevices platform can effectively suport modern solutions for industry (Industry 4.0), smart cities (Smart City), agriculture and many other areas where the application of the Internet of Things brings about measurable results.	11	7.
WIEiT	Scalable simulations of epidemic spread in urban environments	Currently, at the Chair of Computer Science, research is conducted on the development of scalable simulation algorithms (with a view to effective use of the HPC infrastructure, e.g. ACK Cyfronet). Simulations are created in cooperation with urban planners from the Cracow University of Technology, and are used to model the spread of an epidemic and to test the effectiveness of rules imposed by the government (e.g. social distancing) in its prevention.	3	6

Wydział	Nazwa praktyki	Opis praktyki	SDG	USR
	Economic/technical/innovative practices			
WIMiIP	Participation of the Students Research Association of Metallographists in "KRAKsat" project	The project is aimed at sending a research satellite into space by students of the AGH University of Science and Technology and the Jagiellonian University. KRAKsat is one of the first Cubesat satellites in Poland and the first satellite in the world to use ferrofluid, i.e. a magnetic liquid, to control its orientation.	4	7
WFiIS	Additional education offer for students – "Kraków Applied Physics And Computer Science Summer School"	In 2020, "Krakow Applied Physics And Computer Science Summer School" was held and it was addressed to first- and second-cycle students of physics, computer science and related fields. 35 people applied from: the AGH, Poznan University of Technology, Wrocław University of Science and Technology, University of Silesia, one each from Indonesia and Pakistan. The school was conducted remotely, in English, in the first week there were lectures on topics related to the scientific activity of the Faculty and sessions to prepare students for the implementation of projects. During the next three weeks the students conducted scientific projects proposed by the staff and doctoral students of the Faculty of Physics and Applied Computer Science. The summer school ended with a seminar session during which the students presented the results of their work.	4	7
WFiIS	Additional education offer for students – visiting CERN as part of the "Prymusi AGH" (Top Student) programme	As part of the "Prymusi AGH" programme, the Faculty of Physics and Applied Computer Science organized a visit of 70 students to the European Center for Nuclear Research CERN. The prepared program included visits to high-energy physics experiments, the computing center, research conducted on the International Space Station, scientific exhibitions, meetings with foreign scientists and lectures. Students actively participated in classes, discussions and activities illustrating how scientific research is conducted.	4	7
WO	Research for historic monuments	Every year, within the framework of the research network ERIHS.pl, free research is performed on monuments under grants submitted as part of the nationwide MOLAB/FIXLAB PL competition. For this purpose, use is made of access to research infrastructure offered by the E-RIHS.pl consortium for museums and other heritage entities. The E-RIHS.pl itself, in which the implementers participate, is the Polish Consortium for Cultural Heritage Research. The Consortium comprises the Faculty Research Center for Historic Layering, which includes representatives from other Faculties (e.g., the Faculty of Materials Science and Ceramics – historic glass research). The research implemented by the Faculty of Foundry Engineering: • Metallographic research of a cast tombstone of Cardinal Frederic at the Wawel Cathedral; • Metallographic research on cast tombstones in St. Mary's Church; • Metallographic research on the Smolice site relics; • Metallographic research on Bronze Age relics from the Ludwinowo site; • Metallographic studies of a cast Kallimach's plate in the Dominican Church in Krakow;	4	6

Wydział	Nazwa praktyki	Opis praktyki	SDG	USR
	Economic/technical/innovative practices			
WO	Research for historic monuments (continued)	• Metallographic studies of the bells on the Town Hall tower in Krakow; • Metallographic and defectoscopic studies of a cast baptismal font in the Corpus Christi Church in Krakow; • Metallographic and defectoscopic studies of a cast baptismal font in St. Stephen's Church, Krakow; • Metallographic and defectoscopic studies of a cast baptismal font in the Holy Cross Church in Krakow; Metallographic and defectoscopic studies of a cast baptismal font in St. Nicholas Church in Krakow. The research implemented by the Faculty of Foundry Engineering, Research Center for Historic Layering: • Metallographic research on medieval metallurgical slags from Olsztyn; • Metallographic research on a medieval mace from a museum collection; • Metallographic research and computer simulations of a bracelet from Biskupin; • Research on metal artefacts from a ship wreck as part of the E-RIHS.pl collaboration, 4th MOLAB/FIXLAB competition.		

AGH University of Science and Technology · Kraków 2021

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