Development of an Expert Support System for Competency Assessment in Higher Education RESPO-VI (ATP21)

Project Deliverable T1.2.2: Report on competencies needed in the labour market

WP T1: Development and implementation of the RESPO-VI web application
A.T1.2: Analysis of the 21st-century skills and needs that the industry expects from STEM students for integration into the RESPO-VI application

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1. Introduction

Rapid technology advancements are changing the environment in which international businesses operate. More and more businesses want to be successful in the wider, European, and even worldwide markets rather than operating in a more constrained local or national market. These businesses must all take part in global processes that power the global economy. Businesses that want to survive should be ready for frequent and rapid adjustments; as a result, employment arrangements change. Employment contract for an indefinite time period, which was prevalent until recently, is gradually disappearing. Shorter, more flexible forms continually provide new challenges and the need for new skills.

Career development is important for everyone. Employers place a greater value on abilities that promote productive teamwork and creative problem-solving. Individuals are expected to be open, focused on self-initiative training and have a working grasp of schooling and lifelong learning. More and more employers are looking for candidates with skills that go beyond a person's professional competence in their chosen field. The ability to successfully replace a job or profession, plan and act in accordance with changing career chances, develop technical and social abilities, and simultaneously comprehend how and why the gained talents can be utilized are all necessary for future job seekers.

This document presents a report on competencies needed in the labour market, which is prepared based on a comparative analysis of questionnaires from large enterprises, SMEs, research institutes and development centres, the existing KOC-TOP competence model, selected study programmes at NTNU and MPŠ and the findings of the recommendations of the EU (European Skills Agenda, Digital Education Action Plan 2021-2027, European Green Plan, New European Research Area, Eurostudent), OECD, WEF and the Slovenian higher education (HE) space. Based on the findings, the existing KOC-TOP competency model with selected skills was modified to the needs of employers and the specifications of the selected study programmes to better connect qualified STEM students with potential employers. This experience will further improve the level of transferable skills acquired while allowing the education and training programme to be complemented by current and future workforce needs. The findings of this report also serves as a basis for the preparation of the List of STEM Student Competencies for Work and Life in the 21st Century, which is another deliverable under the activity A.T1.2 in the RESPO-VI project.

2. Findings from EU, OECD, WEF and Slovenian HE recommendations

2.1 Relevant EU strategies and initiatives

Our daily lives are constantly changing and forcing us to adapt to new ways to work, learn and take part in society due to technological advancements, global and demographic challenges. To adjust to these changes, individuals need to develop the right skills ranging from basic, such as literacy, numeracy and digital, to vocational or technical skills, but also entrepreneurial and transversal skills, such as foreign languages, personal growth and learning to learn. All of these are needed to maintain an individual's well-being while contributing to society, productivity, and economic growth. European Union strives to equip people in Europe with the necessary skills by implementing various strategies and initiatives, which we summarised in this chapter.

2.1.1 European Skills Agenda

"The European Skills Agenda is a five-year plan to help individuals and businesses develop more and better skills and to put them to use, by:

- strengthening sustainable competitiveness, as set out in the European Green Deal;

- ensuring social fairness, putting into practice the first principle of the European Pillar of Social Rights: access to education, training and lifelong learning for everybody, everywhere in the EU;

- building resilience to react to crises, based on the lessons learnt during the COVID-19 pandemic." [1]

The European Skills Agenda outlines policy priorities and initiatives that will further promote the green and digital transition while enhancing citizen employability and providing skills for the workforce. It is centred around three key work strands:

1. improving the quality and relevance of skills formation;

2. making skills and qualifications more visible and comparable;

3. advancing skills intelligence, documentation, and informed career choices.[2]

To realize the potential of a future recovery plan, it builds upon the first principle of the European Pillar of Social Rights [3], which concerns "the right to quality and inclusive education, training, and lifelong learning in order to maintain and acquire skills that enable them to participate fully in society and manage successfully transitions in the labour market", and upon the ten actions of the Commission's 2016 Skills Agenda [1].

2.1.2 Updated Skills Agenda from July 2020

The European Skills Agenda of July 1st, 2020 sets out a five-year action plan with 12 actions organised around four building blocks:

Table 1. European Skills Agenda structure (cited from [4])

Building Block	Action	Description
Working together under a pact for skills		
	Action 1: Pact for Skills	The Pact will mobilise a concerted effort for quality investment in skills for all working age people across the Union.
Skilling for a job: aligning policies to deliver results		
	Action 2: Strengthening skills intelligence	Includes the use of big data analysis using online job advertisements to examine the skills demanded by employers at regional level and the presentation of information tailored to individuals' needs, making it widely accessible.
	Action 3: EU support for strategic national upskilling action	The Commission will support all Member States to prepare holistic, whole-of-government national skills strategies.
	Action 4: Proposal for a Council Recommendation on Vocational Education and Training (VET)	Organisations providing education and training need to deliver relevant skills along the entire lifelong learning continuum
	Action 5: Rolling out the European Universities initiative and upskilling scientists	Higher education is an essential vehicle to provide students with the skills they need in the future. It is necessary to foster collaboration and mobility of scientist across Europe.
	Action 6: Skills to support the twin transitions	The jobs of tomorrow require skills for the twin (green and digital) transitions.
	Action 7: Increasing STEM graduates and	STEM (Science, Technology, Engineering and Mathematics) skills are critical to drive the twin transitions. Such skills are necessary to use new technologies, and a high level of STEM skills is

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	fostering entrepreneurial and transversal skills	crucial to foster innovation in cutting-edge ICT areas such as AI or cybersecurity
	Action 8: Skills for Life	The COVID-19 pandemic and the related containment measures have underlined the importance of life skills and our capacity to adapt, manage change, and care for each other as a community. Resilience, media literacy, civic competence, financial, environmental and health literacy are key in this context.
Developing tools that empower people to build skills throughout life		
	Action 9: Initiative on individual learning accounts	Direct incentives for people to train, such as individual learning accounts, can make lifelong learning a reality by enabling everyone to participate in learning.
	Action 10: A European approach to micro-credentials	Empowering workers to up- and reskill throughout their entire lives also means making sure that all learning experiences are properly valued. Increasingly, workers are attending short and tailored training and need to get recognition for that. This is achieved with the use of micro-credentials.
	Action 11: New Europass platform	Once the individual has a certificate proving their skills, they need to be able to communicate them when applying for a job or further learning. Europass, an online tool, helps people effectively communicate their skills and qualifications.
Making it happen: unlocking investment		
	Action 12: Improving the enabling framework to unlock Member States' and private investments in skills	EU funds can act as a catalyst, but investment in skills needs to be financed by other public and private investments.

2.1.3 Digital Education Action Plan (2021-2027)

"The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative that sets out a common vision of high-quality, inclusive and accessible digital education in Europe, and aims to support the adaptation of the education and training systems of Member States to the digital age." [5]

It was adopted on the 30th of September 2020 and calls for greater cooperation at European level on digital education due to the challenges that became more apparent during the COVID-19 pandemic. However, it also showcased new opportunities for education, training community (both students and teachers), policy makers, academia, and researchers on national, EU and international levels. Online and blended learning has never before been so important as it uncovered new and creative approaches to coursework and learning activities, but also increased the disparities between those who have access to digital technologies and those who do not. This is further emphasized by different levels of digital literacy and digital capacities of education and training institutions.

The initiative contributes to European Commission's goals for a greener, more digital, and resilient European Union, while also being a key enabler to the implementation of European Education Area [5].

It consists of two strategic priorities and fourteen actions to support them:

Table 2. Digital Education Action Plan (2021-2027) structure (cited from [5])

Strategic priority	Action	Description
Fostering the development of a high-performing digital education ecosystem		
	Action 1	Structured Dialogue with Member States on the enabling factors for successful digital education and skills
	Action 2	Council Recommendation on blended learning approaches for high-quality and inclusive primary and secondary education
	Action 3	European Digital Education Content Framework
	Action 4	Connectivity and digital equipment for education and training
	Action 5	Digital transformation plans for education and training institutions
	Action 6	Ethical guidelines on the use of AI and data in teaching and learning for educators

Enhancing digital skills and competencies for the digital transformation		
	Action 7	Common guidelines for teachers and educators to foster digital literacy and tackle disinformation through education and training
	Action 8	Updating the European Digital Competence Framework to include AI and data-related skills
	Action 9	European Digital Skills Certificate (EDSC)
	Action 10	Proposal for a Council recommendation on improving the provision of digital skills in education and training
	Action 11	Cross-national collection of data and an EU-level target on student digital skills
	Action 12	Digital Opportunity Traineeships
	Action 13	Women's participation in STEM
	Action 14	European Digital Education Hub - strengthening cooperation and exchange in digital education at the EU level.

2.1.4 The Digital Competence Framework for Citizens (DigComp)

Realizing strategies and initiatives across the EU is possible by having common understanding of what digital competence is. This is achieved with a digital competence framework, which serves as foundation for the development of digital skills policies, curricula, and assessments for both the education sphere and labour market. A central role in meeting EU objectives regarding the digital upskilling is played by DigComp and its updated version DigComp 2.2 [6].

The update takes into consideration new phenomena like the new teleworking conditions that have led to new and rising expectations for digital competence on the part of citizens as well as upcoming technologies like Artificial Intelligence, the Internet of Things, and datafication. The necessity to address the environmentally friendly and sustainable aspects of using digital technologies is also growing. Therefore, the current update considers the information, skills, and attitudes that citizens will need considering these developments [7].

2.1.5 ALMA (Aim, Learn, Master, Achieve)

ALMA (Aim, Learn, Master, Achieve) is an initiative put in place by the European Commission, which aims to support young people not in any kind of employment, education, or training (NEETs). Aged 18-30, they have limited access to work and training because of individual or

structural reasons (e.g., lack of academic achievement or vocational skills, migration background, long-term unemployment, disabilities). By enhancing their skills, knowledge, and experience, the initiative allows integration into their home nation while also giving them the chance to forge new connections across Europe. Their social inclusion and finding a position in the job market are the ultimate goals. ALMA is upscaled from a social innovation implemented by Germany in 2008 IdA (Integration durch Austausch), which was then taken over in 2012 by a transnational network of 15 Member States with support from European Social Fund.

This cross-border youth mobility scheme will offer [8]:

- intensive tailor-made training in participant's home country, prior to their stay abroad;

- a supervised stay including work placement with accompanying mentoring service for a period of 2 to 6 months in another EU Member State;

- continued support upon return (coaching and counselling to gain employment or further education).

2.1.6   The European Year of Skills

Green and digital transitions are creating new opportunities for people and the EU economy, but only those with applicable skills can successfully navigate the changes in the labour market and participate fully in society. Providing people with means of obtaining such skills guarantees smaller social differences and makes the transitions fair and just for all. A workforce with in-demand knowledge supports sustainable growth, spurs more innovation, and raises the competitiveness of businesses. Due to a large percent (75 %) of businesses in the EU stating that they have difficulties finding workers with required skills, the European Commission has announced a proposal to make 2023 the European Year of Skills. It plans to give the incentive of lifelong learning by:

- "Promoting increased and more effective and inclusive investment in training and upskilling to harness the full potential of the European workforce, and to support people in changing from one job to another.

- Making sure that skills are relevant for labour market needs, by also cooperating with social partners and companies.

- Matching people's aspirations and skill sets with opportunities on the job market, especially for the green and digital transition and the economic recovery. A special focus will be given to activate more people for the labour market, in particular women and young people, especially those not in education, employment, or training.

- Attracting people from third countries with the skills needed by the EU, including by strengthening learning opportunities and mobility and facilitating the recognition of qualifications."[9]

The proposed year also intends to encourage further development of skill intelligence tools and instruments for increased transparency and easier recognition of qualifications. In meeting those objectives, the European Commission can build upon many already ongoing EU initiatives such

as the European Skills Agenda, Structured Dialogue, New European Innovation Agenda, European strategy for universities, Digital Skills and Jobs Platform and Digital Skills and Jobs Coalition [9].

2.1.7   ESCO platform

European Skills, Competencies, Occupations and Qualifications (ESCO) is a multilingual reference terminology that can be used to describe skills needed in a specific occupation, but also skills acquired through formal, non-formal and informal learning. It can be implemented on different online platforms to provide services like matching job seekers with positions based on their skills and recommend training to those who want to reskill or upskill. Its purpose is to offer a "common language" on occupations and skills that can be utilized by many stakeholders on employment, education, and training matters. This will facilitate job mobility across Europe and, as a result, a more integrated and efficient labour market [10].

2.1.8   EU Skills Panorama

This is an online tool providing quantitative and qualitative central access to data, information and intelligence on skill needs in occupations, sectors, and countries. It also provides information by policy themes. It gives a European perspective on trends for skills supply and demand and skill mismatches [11], while also giving information about national data and sources to help policymakers and policy experts keep up to date with the latest developments, make comparisons with previous trends, and identify anticipated changes. With its data and forecast compilations to identify the top "bottleneck" occupations, it aims to improve Europe's capacity to assess and foresee skill needs. The EU Skills Panorama is managed by CEDEFOP on the behalf of the European Commission [12].

2.1.9   Key Competencies for Lifelong Learning

"Key competencies are a combination of knowledge, skills, and attitudes, which all individuals need for personal fulfilment and development, employability, social inclusion, sustainable lifestyle, successful life in peaceful societies, health-conscious life management and active citizenship." [11, p. 14] They are developed by formal, non-formal and informal learning in all settings, such as family, school, workplace, neighbourhood, and other communities, from early childhood through adulthood. All of them are valued equally because they all help create a successful life in society. They can be used in a wide range of situations and combinations as they overlap and interlock, with one competence's elements supporting another key competence. Consequently, elements of critical thinking, problem solving, teamwork, communication and negotiating skills, analytical skills, creativity, and intercultural skills are present in all key competencies in some form or another [13].

The European Commission collaborates with the EU's Member States to encourage and reinforce the development of key competencies and skills for all. The strategy to encourage key competencies is enacted by:

- "providing high-quality education, training, and lifelong learning for all;

- supporting educational staff in implementing competence-based teaching and learning approaches;

- encouraging a variety of learning approaches and contexts for continued learning;

- exploring approaches to assess and validate key competencies." [14]

Key Competencies for Lifelong Learning is a European Reference Framework, which defines and identifies aforementioned key competencies, provides a reference tool for policy makers, education/training providers, learners etc., and supports efforts at all levels (European, national, regional, and local) to foster competence development in lifelong learning. The Reference Framework sets out eight key competencies:

1. **Literacy competence** represents the ability to identify, comprehend, articulate, create, and interpret ideas, feelings, facts, and opinions in both oral and written form across different academic fields and contexts. It entails the capacity for appropriate and creative interpersonal communication and connection, while serving as basis for further learning and linguistic interaction. Literacy skills can be developed in the mother tongue, language of schooling and/or the official language of a nation or region.

2. **Multilingual competence** defines the capacity to communicate successfully and appropriately in a variety of languages. With its basis on the ability to comprehend, articulate and interpret ideas, feelings, facts, and opinions in both oral and written form, it broadly shares the main skill dimensions with literacy. Intercultural and historical dimensions, as well as the ability to mediate between different languages and media are also integrated into language competencies.

3. **Mathematical competence and competence in science, technology, engineering.** The first competence represents the ability to create and apply mathematical reasoning and understanding of problems in daily life. The emphasis is not only on knowledge but also process and activity. Mathematical competence involves the ability and willingness to use mathematical modes of thought and presentation. Competence in science refers to the ability and willingness to explain the natural world. It is done by observation and experimentation with which evidence-based conclusions are made. Applications of the conclusions in response to human wants or needs represent the competencies in technology and engineering. Understanding citizen's responsibilities and the changes caused by human activity is part of this competence.

4. **Digital competence** refers to the engagement and use of digital technology for learning, at work, and for social participation in a confident, critical, and responsible manner. It covers topics like information and data literacy, communication and teamwork, media literacy, media creation (including programming), digital content creation, safety (including digital well-being and cybersecurity competencies), questions about intellectual property, problem solving, and critical thinking.

5. **Personal, social and learning to learn competence** means the capacity for self-reflection, efficient time and information management, constructive collaboration with others, resiliency, and career management. It includes the ability to deal with complexity and uncertainty, learn to learn, support one's physical and emotional wellbeing, maintain one's physical and mental health, lead a future-focused, health-conscious life, empathize, and manage conflict in a welcoming and encouraging environment.

6. **Citizenship competence** is the ability to participate fully in civic and social life and act as responsible citizens based on one's awareness of social, economic, legal, and political concepts and systems, as well as of global developments and sustainability.

7. **Entrepreneurship competence** defines the ability to act on opportunities and ideas and translate them into values for others. It is based on the ability to work together to design and manage initiatives that have value in terms of culture, society, or finances as well as creativity, critical thinking, and problem solving.

8. **Cultural awareness and expression competence** involve understanding and respecting the various ways that ideas and meaning are expressed and shared creatively across cultures and through a variety of arts and other cultural forms. It entails being actively involved in comprehending, developing, and expressing one's own ideas as well as one's sense of belonging or function in society in a variety of circumstances and ways.

The use of a variety of learning approaches and contexts; support for teachers and other educational staff; and assessment and validation of competence development are three challenges that have been identified in support of competence-oriented education, training, and learning in the context of lifelong learning [13].

2.1.10 Youth Employment Support: A Bridge to Jobs for the Next Generation

The goal of the Youth Employment Support: A Bridge to Jobs for the Next Generation package is to aid young people who are entering the workforce. Its activities are based on the ambitious recovery plan of the European Commission, which offers major EU financing options for youth employment so that all Member States can invest in young people [15].

The Youth Employment Support package is built around four strands that together provide a bridge to jobs for the next generation:

- **A reinforced Youth Guarantee,** the initial version of which was created in 2013 and has already helped 24 million young people gain access to the labour market, has expanded its reach to vulnerable young people (aged 15-29) across the EU, such as those from racial and ethnic minorities, with disabilities, from remote areas etc. It promises an offer of employment, education, apprenticeship, or training within four months of signing up to the Youth Guarantee.

- **A future-proof vocational education and training** strives to modernize systems and make them more appealing, adaptable, and suitable for the digital and green economy. Young people will be better prepared for their first employment with more flexible,

learner-centred vocational education and training, while adults will have more options to enhance or change their careers. It will foster diversity and inclusiveness and assist providers of vocational education and training in becoming centres of vocational excellence.

- **A renewed impetus for apprenticeships** will benefit both employers and young people by providing skilled labour force to a variety of industries. More than 900,000 opportunities have been made available through the European Alliance for Apprenticeships. The revitalized Alliance will encourage national alliances, aid SMEs, and increase participation from social partners including trade unions and employers' organizations. Since the apprentices that are taught now will become highly skilled workers in a few years, the objective is to maintain the apprenticeship opportunities available now.

- **A number of additional measures to support youth employment** include employment and start-up incentives in the short term, with medium term focus on capacity building, young entrepreneur networks and inter-company training [16].

The efforts outlined in this communication support the European Commission's COVID-19 pandemic recovery strategy. They promote the New Industrial Strategy and put into practice the European Pillar of Social Rights. Other European Commission measures, including the European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience, help increase employment among young people [15].

2.1.11   New European Research Area

European Research Area (ERA) is a single, borderless market for research, innovation, and technology across the EU where countries collaborate and improve their research policies and systems and where free movement of researchers, knowledge and innovation is encouraged. Established in 2000, it has made significant progress over the years, but the current environment forced re-evaluation on strengthening its role, better definition and carrying out its objectives, and making it more appealing as a common space for producing valuable research and innovation.

Therefore, a **new European Research Area for Research and Innovation** was adopted by the European Commission. It is built on the principles of excellence, competition, openness, and talent priority and will enhance Europe's research and innovation landscape, hasten the EU's transition to climate neutrality and digital leadership, aid in its recovery from the societal and financial effects of the coronavirus crisis, and increase its resilience against future crises [17]. To achieve its goals, three additions were created:

- **Establishment of a new ERA governance**, with the creation of a dedicated expert group (ERA Forum), allows for closer cooperation on the implementation of ERA initiatives between the European Commission and EU countries.
- Adoption of **a Pact for Research and Innovation** in Europe, which lays out 10 shared values and principles that will guide research and innovation in Europe, as well as cooperation with the rest of the world. It establishes priority areas for collaborative action,

sets ambitions for investments and reforms, and streamlines coordination and monitoring.

- **An ERA Policy Agenda with concrete actions**, annexed to the Council conclusions on the ERA governance, lists 20 concrete ERA actions that will take part between 2022 and 2024 to support the priority areas defined in the Pact for Research and Innovation [18].

2.1.12   European Framework for Research Careers

Innovation Union commitment no. 4 on ERA requests "Comparable research career structures", which were lacking in the EU. There wasn't an accessible and open internal labour market for researchers, it was dispersed across the country, jobs in academia, industry, and other sectors were divided. Although there is cross-country and cross-sector mobility, there are still several barriers. Because switching industries can be extremely tough, career decisions are frequently final. Early career researchers may not be aware of the diversity of opportunities across work sectors because research careers usually lack a clear and transparent prospective, with employers frequently being unaware of the skills researchers possess and the advantages they could provide for their business. The **European Framework for Research Careers** was created as a reference tool to compare career hierarchies across industries and countries, helping researchers identify job offers and employers find suitable candidates. The descriptors are applicable to all researchers, whether they are employed by businesses, non-profit organizations, research institutions, research universities, or universities of applied sciences, because the framework is sector neutral. The four profiles serve as a bridge over sectoral or national divisions rather than replacing local or national nomenclature [19], and have the following titles:

- **R1 First Stage Researcher** – individuals, doctoral candidates, who conduct research under supervision in industry, research institutes or universities. Desirable competencies include developed integrated language, communication, and environment skills, especially in an international context.

- **R2 Recognised Researcher** – includes Doctorate degree (PhD) holders who have not yet established a significant level of independence and researchers with an equivalent level of experience and competence. Desirable competencies include understanding the agenda of industry and other related sectors, understanding value of their research work, communication with wider community about their area of expertise, promotion of advancements in society and mentoring First Stage Researchers.

- **R3 Established Researcher** - describes researchers who have developed a level of independence. Desirable competencies include relevant collaborative relationships, effective communication, innovative research, forming of research consortia, securing research funding and commitment to own and other's professional development.

- **R4 Leading Researcher** – represents researchers who are leaders in their research area or field. The head of an industry R&D lab or the team leader of a research team falls under this category. Leading researchers may, as an exception in some disciplines, include those who work alone. Desirable competencies include expert managing of projects and other researchers, long-term planning for the research community, expert networking,

innovative and creative environment creation and acting as a professional development role model for others [20].

2.1.13   Eurostudent

The Eurostudent project gathers and analyses comparable data on the social aspect of European higher education. The social and economic circumstances of students are covered over a wide range of issues. EUROSTUDENT VII Synopsis of Indicators 2018–2021 recognizes a few key skills that contribute to successful employment after studies.

The most important skills students can get while studying are those developed during study-related work or internships. A job provides great value in the form of practical knowledge of the profession, work experience as such, and practical life skills. In addition to using theoretical knowledge in a practical setting, it enables them to begin networking early, giving them the chance to find employment more quickly after completing their studies. Work-related learning environments have also shown to be beneficial, especially for developing social and entrepreneurial skills. To help students navigate their study-work balance, which has become more feasible with blended learning, managerial and planning skills, along with flexibility, play a big role. After the coronavirus pandemic, education programmes are becoming more accommodating and are offering remote learning, however this calls for diligence and knowledge of digital skills from students. One aspect that increases individual's chances of employment is also their national and international mobility; language skills, independence and previous intercultural experiences all increase willingness to move [21].

2.1.14   UNESCO Transversal skills

UNESCO-UNEVOC is an International Centre for Technical and Vocational Education and Training, which is focused on acquiring knowledge and skills for the workplace and supports equitable and sustainable economic growth by assisting youth and adults in developing the skills necessary for employment, decent work, and entrepreneurship [22].

The demand for transversal skills is increasing as learners need to successfully adapt to changes and lead meaning and productive lives. As defined in UNESCO-UNEVOC's TVETipedia, transversal skills are ones that are typically considered as being applicable in a wide range of situations and work settings rather than being specifically tied to a particular career, task, academic discipline, or area of expertise. They include six domains:

- **critical and innovative thinking**

- **inter-personal skills** (presentation and communication skills, organizational skills, teamwork, etc.)

- **intra-personal skills** (self-discipline, enthusiasm, perseverance, self-motivation, etc.)

- **global citizenship** (tolerance, openness, respect for diversity, intercultural understanding, etc.)

- **media and information literacy** (the ability to locate and access information, as well as to analyse and evaluate media content)

- **others** (physical health or religious values, etc.) [23]

2.2 Key competencies for Slovenian HE

Rapid technology advancements are changing the environment in which businesses operate. Many want to succeed in wider markets and therefore have to adapt to changes, which are then also transferred to future job seekers. Transversal skills are gaining greater value and distinguish two candidates with the same educational background, giving those with self-initiated training, social skills, etc. a bigger advantage. Creating national and international initiatives in the field of career guidance is crucial for individual's development as offering help and additional education options encourages the development of key competencies [24].

2.2.1 Skills for the future

Slovenia offers career guidance on two levels: with national initiatives and lifelong guidance tools/trainings/projects/events.

Within national context, Slovenia has accepted the **OECD Skills Strategy** and in its diagnostic report specified 3 priority areas for action:

- empowering active citizens with the right skills for the future (a portfolio of cognitive, socio-emotional and discipline specific skills that equip them to learn throughout life, interact effectively with others and solve complex problems);

- fostering a culture of lifelong learning;

- collaborating to strengthen skills.

It has also identified skills challenges facing Slovenia, which include equipping young people with skills for work and life, improving skills, boosting employment, attracting, and retaining talented people, utilizing people's skills in workplaces, using skills for innovation and entrepreneurship, etc.

Countries can reduce mismatches by efficiently analysing, anticipating, and communicating information on the evolving need for skills. Slovenia doesn't have a comprehensive system for assessing and anticipating skills, but it is working to improve what it does have. The Ministry of Labour, Family, Social Affairs and Equal Opportunities and the Ministry of Education, Science and Sport have central roles in skills anticipation activities. The main forms of **skills anticipation** according to EU Skills panorama in Slovenia are:

- collecting and analysing administrative data on job openings and unemployment, including information from the Labour Force Survey;

- surveys of employers conducted by the Employment Service of Slovenia and employers' organisations, as well as surveys conducted by the Statistical Office of the Republic of Slovenia and labour market intermediaries;

- skills forecasts within international networks, primarily CEDEFOP;

- discussions with key stakeholder representatives.

Employment Service of Slovenia gathers skills intelligence and publishes bi-annual employment expectations analyses, **Employment forecast**, based on it. It is one the most important organizations in the Slovenian labour market. The research includes Slovenian companies with more than 10 employees and focuses on business expectations and services, employment in the upcoming six months, as well as difficulties in obtaining adequate workers in the previous six months. Additionally, it prepares the quantitative research **Occupational barometer** that demonstrates the relationship between offers and requests for occupations for the upcoming year. The study is based on data gathered by employment agencies, counsellors for the unemployed, and counsellors in contact with companies. Results of the barometer forecast include a given profession's deficit, balance, and surplus on a national level. The Employment Service of Slovenia is also carrying out the **Active Employment Policy** program, which helps unemployed people acquire skills that are relevant to the job market and is primarily targeted at long-term jobless people and other vulnerable groups that require additional support to enter the workforce.

2.2.2   Tools for lifelong career guidance

Regarding lifelong guidance, tools for career guidance focusing on clients' career paths were developed inside the Employment Service of Slovenia, where they present an important source for career counsellors who interact directly with job searchers and the unemployed.

Euroguidance Slovenia provides **Kam in kako (Where and how)** online ICT guidance tool in 2 versions: one for students at elementary schools, VET schools, general upper secondary schools, and their guidance counsellors, and one for higher education students, the unemployed and all citizens interested in changing their career. It serves as a basis for individual career counselling and guidance. Individuals can review their responses regarding their interests, skills, and proposed careers independently or in collaboration with a school/career counsellor.

The Employment Service of Slovenia offers **modular training for career counsellors in lifelong career orientation** from the employment and education sectors, with the goal of providing career counsellors with the necessary knowledge on useful working methods and theoretical background, as well as encouraging networking among career counsellors from various fields. The 160-hour multidisciplinary training consists of individual, group, and online work. It is broken down into 4 modules (career orientation, guidance, lifetime guidance career tools, and working with groups in career orientation) for 4 separate practice areas (employment counsellors, education counsellors, HR, and NGO). The training is offered as part of the Lifelong Career Guidance Service Development Project.

Employment Service of Slovenia also developed some other guidance tools, such as:

- tools for modular workshops for development of job searching competencies on the basis of competence profile job searching;
- **eSvetovanje (eCounselling)**, which is a self-evaluation guidance tool for career planning;
- adapted from Dr. Amundson, **the scale for evaluating competency**, which serves as a self-help tool for career orientation;
- **Karierni Kompas (Career compass)**, a tool for career counselors created by CINOP (Euroguidance Netherlands) and translated for experts in the field of career orientation;

- **CH-Q method** for Career and competence self-management workshop for the unemployed, youth and long term unemployed.

Another important aspect that helps with career success is international mobility. **Cross-border seminar** is a way for guidance practitioners from central European nations to collaborate internationally on guidance and learn about future professions and skills. Additionally, the seminar serves as good practice that might be used in other nations. Another mobility opportunity is offered through **Academia network,** which is a professional learning mobility exchange and a chance for guidance practitioners to familiarize themselves with the guidance system and guiding practices in other European countries.

2.2.3   Initiatives tailored to address skill development in the employment/education sector

Initiatives can also be tailored to address skill development in the employment/education sector for the future. An example is a project **Increasing effective coordination of supply and demand in the labour market,** managed by the Employment Service of Slovenia, which aims to develop tools suitable for high-quality forecasts of worker needs, skills, and competencies. This will help lessen structural labour market imbalances and speed up the process of getting unemployed people back to work. This project also develops a methodology to establish short-term employment needs for employers and updates the current methodology used to identify those needs.

In order to encourage the delivery of adequate training and counselling activities to employees, based on the identification of training/skills needs, the Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia manages numerous programs. In collaboration with the Ministry of Education, Science, and Sport and the Ministry of Labour, Family, Social Affairs, and Equal Opportunity they support **Competence Centres for Human Resources,** where employers in the industry work together to identify key competencies and train employees in accordance with the necessary skills and deficits that need to be filled.

The annual **Day of Open Doors of Slovenian Economy** educates schoolchildren and their parents about the jobs and competencies required by Slovenian employers. They can connect with employers, positions, necessary skills, and employees in more than 100 businesses to talk about future employment and help with career decisions.

The Ministry of Education, Science, and Sport and the European Social Fund are jointly funding the diversification of schools, **Popestrimo šolo** programme, in which schools are encouraged to focus on professional development in order to boost student competency. The project's objective is to plan and coordinate a variety of group and individual activities that help students and teachers identify and develop their abilities and actively engage them in lifelong learning [24].

2.3 OECD Skills Strategies

The OECD emphasises that skills are the key to shaping a better future for individuals and countries to succeed in an increasingly interconnected and fast-changing world. In the recovery from the COVID-19 pandemic, countries will need to take coordinated actions to help graduate and postgraduate students find their first jobs and make effective use of the skills they have acquired during their studies in the workplace. In the long term, megatrends such as globalisation, climate changes, technological advances and demographic changes will continue to transform work and society, and countries should prepare today, by developing the skills needed to succeed in the world of tomorrow. Countries should strengthen the management of skills development policies to make their formal and informal skills systems more resilient and adaptable for the future.

The OECD is working with several countries to assess their challenges and opportunities in skills development, identify priority areas for actions and make concrete and targeted policy recommendations to build more effective skills systems that promote employment, productivity and social cohesion. Using the OECD Skills Strategy framework [25], they analyse the performance of skills in individual countries, taking into account the following aspects:

- the development of relevant skills across the life cycle from childhood to adulthood,
- the effective use of skills at work and in society,
- activating the supply of skills in the labour market, and
- strengthening the governance of the skills system.
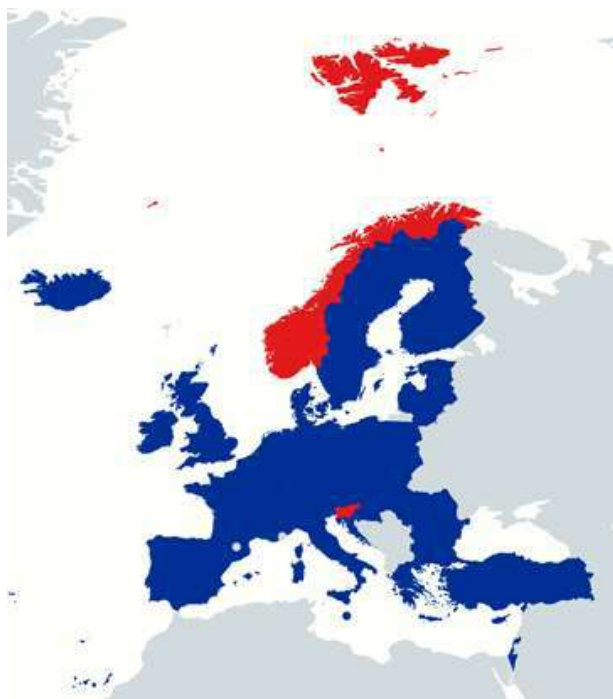
Figure 1. OECD countries in EU (blue colour) and selected countries from RESPO-VI project (red colour)

Slovenia and Norway are among 30 countries where OECD Skills Strategy projects have been performed. Because the situation in each country is unique, also national project teams collaborate in these projects to evaluate the state of each country. In the following two subsections, we summarize the key findings in the OECD Skills Strategy Diagnostic Reports for Slovenia and Norway. Both countries are among the four countries in the OECD with the highest levels of income equality.

2.3.1 OECD Skills Strategy Diagnostic Report: Slovenia

The OECD [26] identifies Slovenia as a relatively prosperous country with a good quality of life. However, jobs in the country have been affected by the global financial crisis and its recovery is not yet complete. Slovenia's population is ageing faster than in most other OECD countries, which means there are fewer workers to meet skills needs and fewer salary earners to support public spending. At the same time, highly skilled people are increasingly mobile in search of better education, jobs and lives. Technology and digitalisation continue to change the way Slovenians learn, work and live, changing some jobs and creating others. A better-skilled population, motivated to develop skills and knowledge and ready to realise its potential, will be key to meeting the challenges and exploiting the opportunities of the future.

Slovenia has successfully increased the quality of education in recent years. However, too many people - young and old - are still not equipped with the right skills for work and life. The OECD recommends that in the future Slovenia will need a better understanding of how the skills needs

are changing, and greater capacity building and stimulations for students, educators, workers, and employers. Slovenia must continue to build a culture of lifelong learning and enable all adults to develop their skills over time and fill skills gaps. Achieving this will require more systematic cooperation within and between ministries and stakeholders.

Positive conditions in Slovenia are:

- high standards of living
- high level of income equality
- high levels of personal security
- relatively unspoiled natural environment and
- high educational attainment.

A vision of Slovenia 2050 is "to promote a society where people learn for and through life, are innovative, trust one another, enjoy a high quality of life and embrace their unique identity and culture" and here skills have a key role to achieve this vision. Higher levels of skills are associated with higher productivity, employment and earnings. The OECD has identified three areas for action in Slovenia:

(i)   Empowering active citizens with the right skills for the future: develop a portfolio of cognitive, socio-emotional and discipline-specific skills that equip them to learn throughout life, interact effectively with others, and solve complex problems. A well-informed and responsive skills system is essential for encouraging active citizenship and giving Slovenians the best chance of developing the right skills for a changing world. One such system can be also the RESPO-VI online application.

(ii) Building a culture of lifelong learning for all actors – individuals, employers, educators, policymakers and others.

(iii) Working together to strengthen skills: systematic cooperation between different ministries and stakeholders to recognize the economic and social needs.

2.3.2   OECD Skills Strategy Diagnostic Report: Norway

Norway is the first country to work with the OECD on a project to put the OECD Skills Strategy into practice. The OECD has identified 12 skills challenges [27] for Norway, which have been developed through a series of interactive workshops held with a variety of stakeholders. Norway's future competitiveness will depend more on the skills of its people than on the wealth of its natural resources. For this reason, Norway is investing significantly in developing the skills of its population.

Norway's long-standing commitment to ensuring equal access to education and training is reflected in its high expenditure on education, which at 7.6% of GDP is among the highest in the OECD countries. A more efficient skills system is needed to increase Norway's competitiveness and maintain a high standard of living in the future. Young people and adults will need opportunities, motivation and enthusiasm to improve and use their skills already in the early years of schooling and throughout their lives.

Wage costs in Norway have risen steadily and real labour costs have thus increased faster than productivity. The high labour costs are partly a result of the high wages prevailing in Norway and partly to the low average working hours. The use of part-time work and the relatively low number

of hours in a full-time working week contribute to maintaining a healthy work-life balance and can contribute to the high level of life satisfaction of Norwegians. Maintaining such a lifestyle requires an efficient and skilled workforce and a skills system that activates and uses all available skills.

Positive conditions in Norway are:

- relatively early recovery from the crisis
- low unemployment, low inequality and low inflation
- flexible working hours and labour market
- invests heavily in education
- skills are central to international competitiveness
- high participation rates in education, including in higher education
- support for lifelong learning
- solid education system with second chance options
- equality of access (social and geographic)
- regional distribution of education institutions
- strong economy and strong public sector
- knowledge based economy
- clear signals from industry on demand for skills
- effective government and well-functioning public sector
- flexible and rapid decision making
- clear and central responsibility for skills development allows for effective policy development
- stable economic growth
- trust between government and population
- large public sector, including in education, means that there are opportunities to make changes
- close cooperation with social partners, business and industry

Main challenges from stakeholder point of view facing Norway skills development:

- high dropout rates from upper secondary
- low motivation among students
- lack of skills in science and technology
- generous funding increases the use of tertiary education for sorting purposes rather than for gaining useful skills
- lack of system to evaluate quality
- education policy pays little attention to future skills demands
- difficulties in recruiting adequately qualified teachers
- low unemployment levels undermine motivation for employers and employees to focus on skills development
- limited rewards for better skills of the individual
- poorly functioning immigration system for high skilled workers
- SMEs lack tradition of seeking workers with formal education

- as new forms of employment, entrepreneurship increase, traditional employee-employer relationships lose their role
- lack of coordination among regional agencies
- balance between regional coverage of higher education establishments and quality of institutions
- lack of a system to forecast skills needs and disseminate information

2.3.3 OECD Skills Strategy comparison between Slovenia and Norway

The OECD identified nine skills challenges Slovenia and Norway face in developing, activating and using skills. The nine challenges are described under each of the main pillars of the OECD Skills Strategy and are framed as outcome statements. The first six challenges refer to specific outcomes across the three pillars of developing, activating and using skills. The next three challenges refer to the "enabling" conditions that strengthen the overall skills system, by helping to boost outcomes across more than one pillar.

Table 3. Comparison of skills challenges between Slovenia and Norway as defined by the OECD

	Slovenia (2017 Report)	Norway (2014 Report)
Developing relevant skills	Challenge 1. Equipping young people with skills for work and life • many recent graduates lack strong cognitive and socio-emotional skills • effective teaching strategies are not used widely enough • co-operation between higher education institutions and employers is relatively weak Recommendations: • Develop high levels of skills for work and life for students • Adapt Slovenia's higher education system so that it is more responsive to current and future labour market needs.	Challenge 1. Building strong foundation skills for all • relatively large share of the adult population in Norway has poor foundation skills • young adults are below average in literacy and are average in numeracy
	Challenge 2. Improving the skills of low-skilled adults • almost 400 000 adults – have low levels of literacy and/or numeracy • to achieve at least basic levels of cognitive skills • accessible, high-quality lifelong learning opportunities •	Challenge 2. Reducing drop-out • the large number of students drop out of upper secondary school • lower completion rates among students of vocational courses compared with students enrolled in more general courses

	Recommendations: • Encourage and motivate low-skilled adults to improve their skills • Provide more flexible modes of learning and strengthen systems for validation of non-formal and informal learning	
		Challenge 3. Informing educational choices • shrinking numbers of jobs in elementary occupations and production • better public data on current and projected labour market needs and professional career guidance services for young people in education and for adults seeking to reskill can help people make better choices
Activating skills supply	**Challenge 3. Boosting employment for all age groups** • older, lower-educated and long-term unemployed adults, and youth need better support and incentives to work Recommendations: • Strengthen individuals' incentives to supply their skills, and employers' incentives to hire • Tackle additional barriers to labour market participation for disadvantaged groups • Improve employment services to enhance outcomes, especially for NEETs	**Challenge 4. Enhancing labour market participation among those receiving disability benefits** • the highest rates of sickness absence • 10% of all working age adults receive permanent or temporary disability allowances
	Challenge 4. Attracting and retaining talent from Slovenia and abroad	**Challenge 5. Encouraging labour market attachment among low skilled youth** • those who do not complete upper secondary school are almost four times more likely to be unemployed than those who had completed tertiary education
	• help to meet skill needs and infuse new knowledge, technology and innovations into the economy • growing number of tertiary-educated and high-skilled Slovenians are emigrating (brain-drain)	**Challenge 6. Ensuring Norwegians remain active longer** • Almost one quarter of people over 55 years old are registered as disabled

	- Slovenia attracts a relatively small number of international students, only few courses are offered in English **Recommendations:** - Adjust the tax mix to make working in Slovenia more attractive for highly skilled individuals - Make it easier for highly-skilled non-EU nationals to enter the Slovenian labour market - Expand the use of English in higher education programmes	which is nearly double the OECD average
Using skills effectively	**Challenge 5. Making the most of people's skills in workplaces** - Slovenia's skill use performance is average, but well below top-performing countries - on-the-job learning is used relatively infrequently - larger firms in Slovenia use workers' skills and adopt High-Performance Work Practices (HPWP) less frequently than smaller firms **Recommendations:** - Encourage the diffusion of HPWP in Slovenian firms - Monitor how Slovenia's labour market institutions and other factors affect firms' use of their employees' skills	**Challenge 7. Engaging employers in ensuring a highly skilled workforce** 20% of Norwegian workers consider that they are over-qualified and 15% believe they are under-qualified for their current jobs - workers with low proficiency levels in low-skilled occupations may not benefit employer funded training
	Challenge 6. Using skills for entrepreneurship and innovation	**Challenge 8. Promoting innovation and entrepreneurship** - business start-up rates are among the lowest in OECD - the level of self-employment as a share of total employment is low **Recommendations:** - innovative businesses and skilled entrepreneurs to run them
	- relatively weak contribution of the higher education sector (R&D) to innovation and market - lack of entrepreneurial thinking and 'spirit' in the education **Recommendations:**	**Challenge 9. Enhancing the use of migrants' skills** - over-qualification is relatively widespread among the foreign-born population - migrants offer a significant stock of untapped skills

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	• Strengthen efforts to implement the reforms to Slovenia's innovation system • Improve opportunities, skills and attitudes towards entrepreneurship	
	Challenge 7. Inclusive and effective governance of the skills system • Ministries too often work independently of one another • Municipalities play a relatively limited role in the policy process • Existing mechanisms for engagement with stakeholders are not successfully motivating stakeholders to support decisions Recommendations: • Evaluate the government's performance in engaging stakeholders • Encourage inter-ministerial co-ordination and collaboration • Increase engagement of local levels in skills policy making and implementation • Boost public sector capacity	**Challenge 10. Facilitating a "whole-of government approach to skills"** • complex vertical coordination at national, district and municipal level
Strengthening skills system	**Challenge 8. Enabling better decisions through improved skills information** • keeping today's skills mismatches low will become increasingly difficult due to digitalisation, technological change and globalisation • lack of a comprehensive skills assessment and anticipation (SAA) system • only limited information on current and future skills needs is readily available (no user-friendly online one-stop shop for information) Recommendations: • Develop a more comprehensive and robust skills assessment and anticipation system • Disseminate information about current and future skills effectively to different users	**Challenge 11. Ensuring local flexibility and adaptability for nationally designed policies** • geographic diversity is reflected in the unique skills profiles and needs • subnational authorities play an important role in implementing national skills policies
	Challenge 9. Financing and taxing skills equitably and efficiently	**Challenge 12. Building partnerships at the local and national level to improve implementation**

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- spends less on education per student, than the OECD average - vocational students in particular are disadvantaged by relatively low funding - individuals contribute less to their tertiary education than in three-quarters of OECD countries Recommendations: - Ensure that vocational education at all levels receives the financial support needed to develop strong general and technical skills - Identify financial support that effectively encourages firms and adults to invest in skills	- Employers, trade unions, education and training institutions, researchers and students should play a role in tackling Norway's skills challenges Recommendations: - Broad-based partnerships, which develop shared goals while mobilising the respective expertise and experience of each partner, are most likely to develop innovative approaches to addressing Norway's emerging skills challenges.

2.3.4   OECD Skills Profiling Tool

Everyone has different skills that enable them to do different types of work. Therefore, the OECD has developed a tool that assesses skill sets to help individuals and careers advisers to identify a person's strengths and suggests some occupations that use these skills to help them decide on their next career path [28]. To identify the skills profile, the tool needs information on the hard skills of the individual (technical knowledge and training) and on the soft skills (personal habits and characteristics). The tool obtains information on hard skills from the given level of education, the occupation with which the individual most closely identifies and the frequency with which the individual performs certain activities. To assess soft skills, the individual takes personality tests. These tests focus on the main soft skills that are most frequently referred to in the workplace:

- customer and personal service,
- time management and self-management skills,
- motivation and commitment, and
- creative thinking.
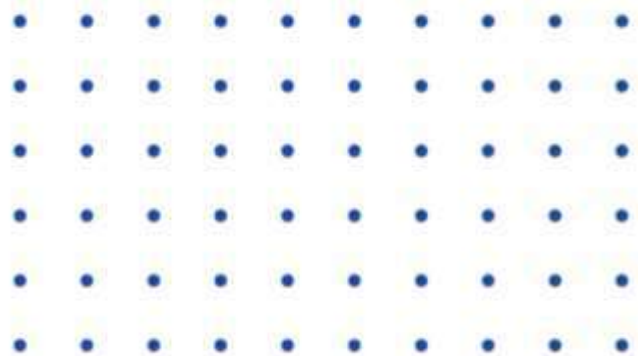
2.4 World Economic Forum
2.4.1   The Future of Jobs Report 2020

The Future of Jobs report [29], published by the WEF, presents the jobs and skills of the future, with a focus on monitoring the pace of change. It aims to highlight:

- the challenges posed by the COVID-19 pandemic in 2020 and the history of economic cycles, as well as
- the expected outlook for technology adaptation, jobs and skills in the coming years.

In Figure 2, we summarize the key findings of the WEF report.
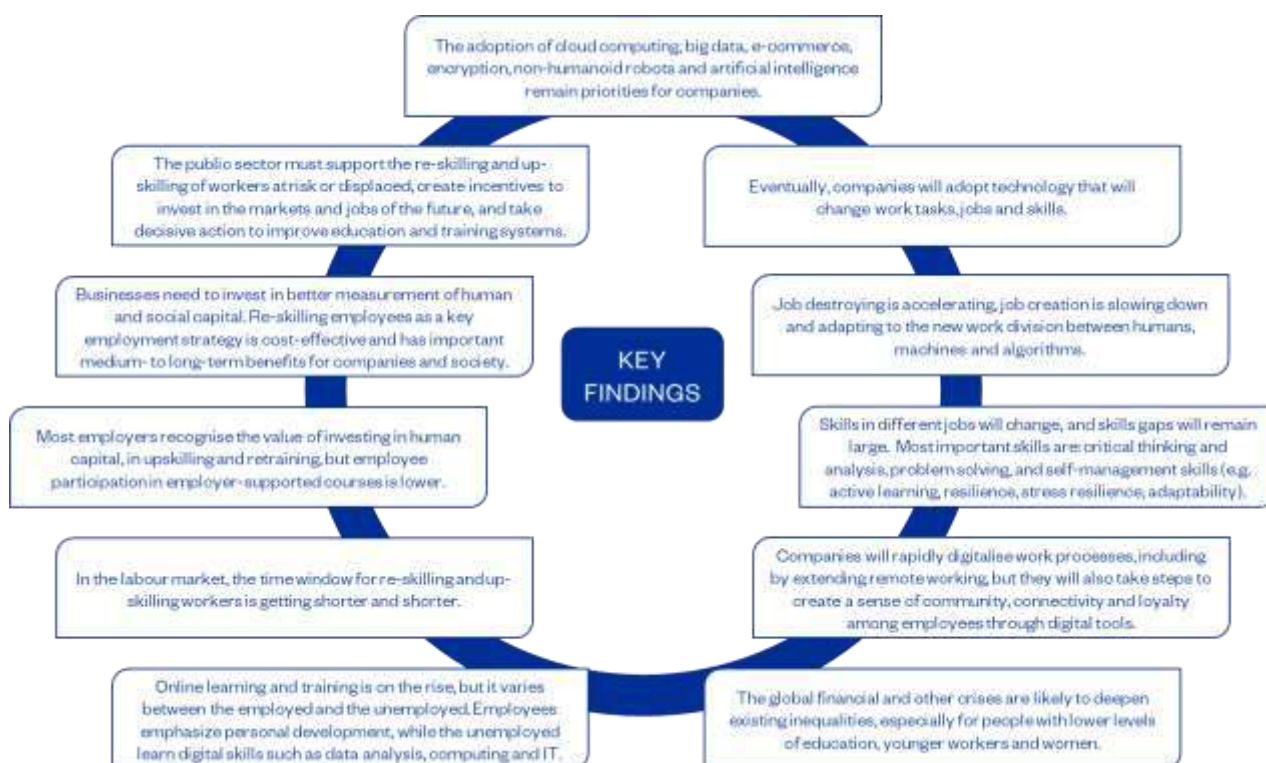
Figure 2. Key findings of the Future of Jobs Report from 2020.

The crisis in recent years has forced companies to:

- increase remote working,
- accelerating the adoption of digitalisation, and
- accelerating the introduction of automation.

All these decisions are changing the skills that jobs will need in the coming years. Machines will continue to replace human labour, but more machines need operators with the right skills, so re-skilling the existing workforce in current jobs is unavoidable. New jobs will demand specialised profiles in the following fields:

- Data analysis
- AI and machine learning
- Big data
- Digital marketing and strategy
- Process automation
- Business development
- Digital transformation
- Information security
- Software and applications development
- Internet of Things

The report also provides in-depth information for 15 industrial sectors and 26 countries, but Norway and Slovenia are not included among them. We looked in more detail at the Education sector in general. Below is a list of skills that are expected to become increasingly important in education in the coming years:

- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Emotional intelligence
- Critical thinking and analysis
- Complex problem-solving
- Analytical thinking and innovation
- Reasoning, problem-solving and ideation
- Service orientation
- Resilience, stress tolerance and flexibility
- Leadership and social influence
- Systems analysis and evaluation
- Persuasion and negotiation
- Technology use, monitoring and control
- Instruction, mentoring and teaching

In the education sector, there are also some technologies, which are expected to be adopted in the next years. In Figure 3 we present on the left side these emerging technologies, and on the right side, the most common barriers education institutions face when adopting such new technologies in the education process.

Education-related institutions have also identified the top 5 measures that will change working strategies due to the COVID-19 crisis:

- Accelerate the digitalization of work processes (e.g. use of digital tools, video conferencing)
- Provide more opportunities to work remotely
- Accelerate the digitalization of upskilling/ reskilling (e.g. education technology providers)
- Accelerate automation of tasks
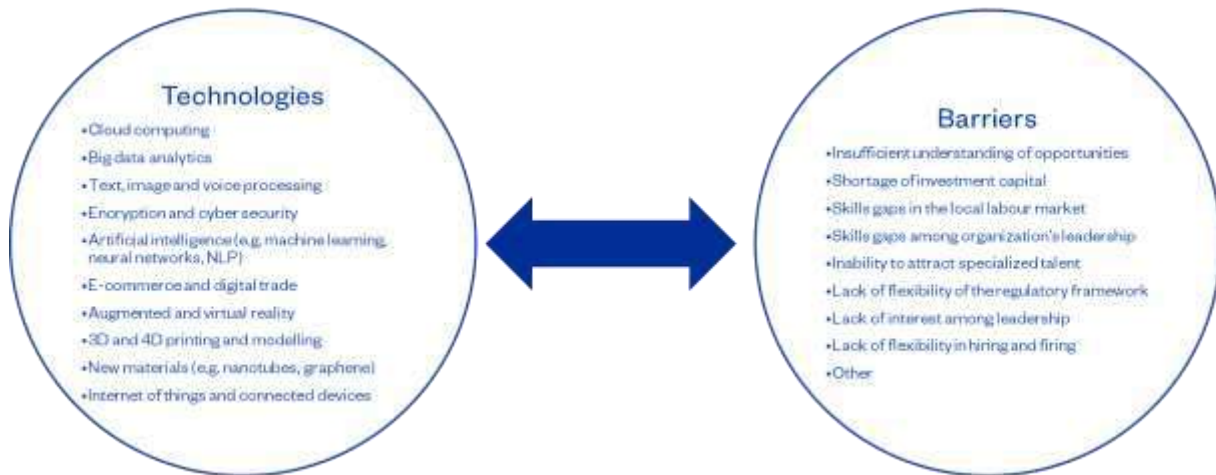- Accelerate ongoing organizational transformations (e.g. restructuring)

Figure 3. Emerging technologies and barriers to adopt them in education sectors

2.4.2 Forum's Reskilling Revolution platform

Forum's Reskilling Revolution platform (https://www.reskillingrevolution2030.org/) was launched in January 2020 and since then it was used by more than 100 million people. The platform prepares the world's workforce to acquire the skills needed for their future careers, as technologies such as artificial intelligence enable increasing automation. More than 350 organisations have endorsed the initiative, including Adecco, Coursera, the Education Commission, the French Government, LinkedIn, UNICEF, etc.

Technological change, the COVID-19 pandemic and the green transition show large skill and education gaps, which must be closed. Therefore, urgent investment in human capital for reskilling and upskilling around the world is crucial to update current teaching and learning programmes and to avoid skills mismatch in the future. The next decade is expected to play a key role in determining the future forms of work and education in the 21st century.

The platform started with several initiatives and actions. For the RESPO-VI project we focused on the following presented below.

2.4.3 Education 4.0 Initiative

There is an urgent need to update education systems to equip children and students with the right skills to navigate the future of work and the future of societies. The Education 4.0 framework includes both the technical and human-centric skills needed to shift learning experiences more closely to the future of work. The initiative is more directed to primary and secondary school systems, which have a critical role in preparing citizens and the workforce of the future that should be more inclusive, cohesive and productive. First, a system-level change is necessary to connect education ministries, educators and private sector leaders to start collaborating and think about the creation of holistic education systems. Secondly, connection across schools and school

systems is a key to preparing the teaching workforce to acquire and use the skills of the future on the path to the transition to Education 4.0.

High-quality learning in" Education 4.0" is characterized by eight critical points as depicted in Figure 4.

Global citizenship
- building awareness about the wider world
- sustainability
- active role in the global community

Innovation and creativity
- complex problem-solving
- analytical thinking
- creativity
- systems analysis

Digital Technology
- programming
- digital responsibility
- use of technology

Interpersonal skills
- empathy
- cooperation
- negotiation
- leadership and social awareness

Personalized and self-paced learning
- individual needs of each learner
- flexible learning

Accessible and inclusive learning
- everyone has access to learning

Problem-based and collaborative learning
- project- and problem-based content delivery
- peer collaboration
- mirroring the future of work

Lifelong and student-driven learning
- continuously improves on existing skills and acquires new ones based on individual needs
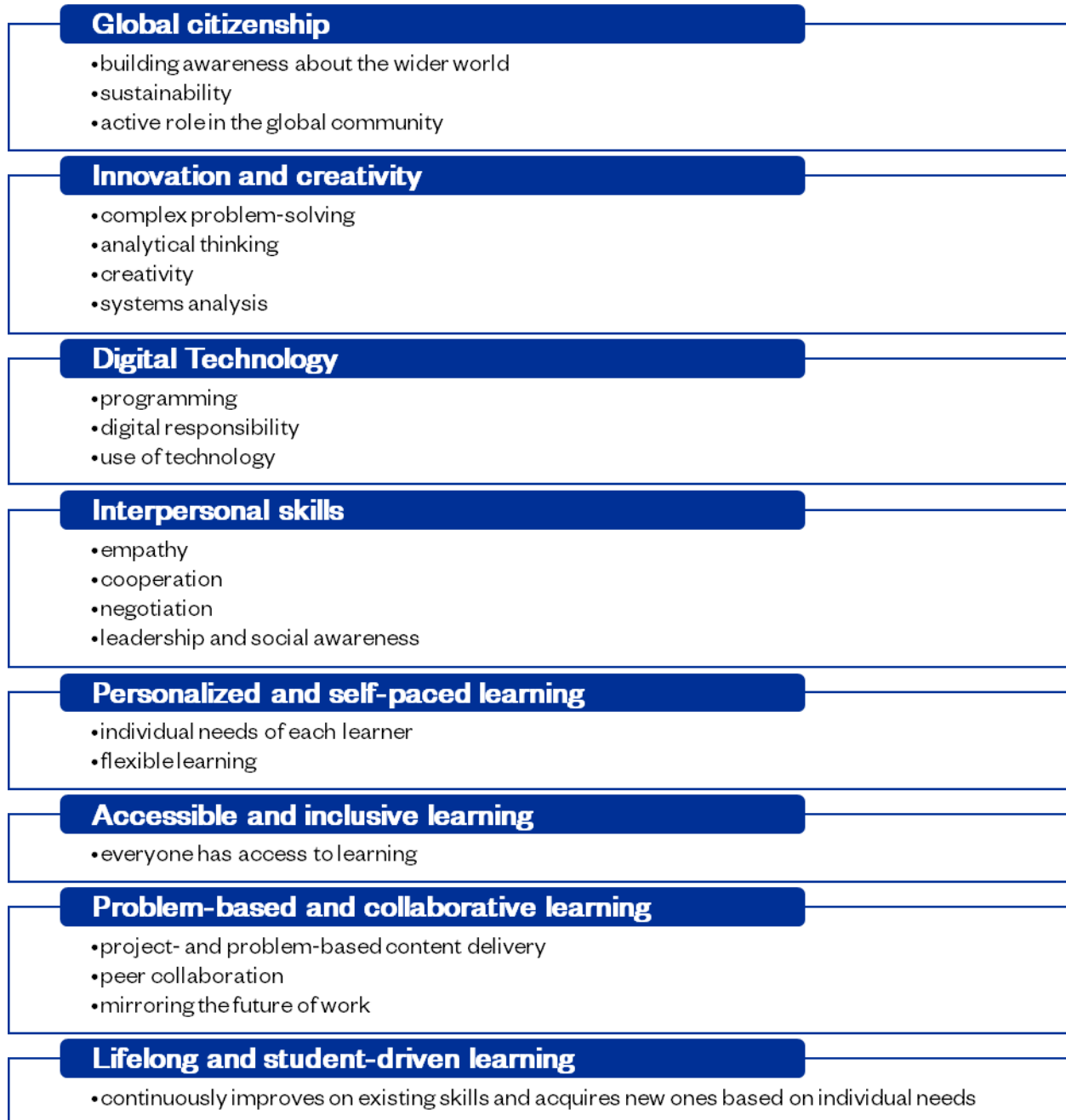
Figure 4. Eight characteristics for Education 4.0

2.4.4   Global Skills Taxonomy

Many training providers and employers now use their own definitions and standards for skills, which creates further difficulties in matching workers with learning opportunities and, conversely, jobseekers with job competencies. The WEF has proposed a framework for a global skills taxonomy [30] as a first step towards a skills-based labour market. The proposed taxonomy builds on the work done by ESCO (European Skills, Competencies and Occupations) and the Occupational Information Network (O*NET) framework by incorporating additional emerging skills, particularly in relation to future work trends. It aims to use a matrix approach that brings together skills and occupations. This taxonomy focuses on skills that are known to be increasingly important in a rapidly changing labour market and aims to serve as a "universal adapter" for existing taxonomies in the field of education supply and demand by allowing users to compare their taxonomy against this framework. This proposed global skills taxonomy consists of:

- Definitions: a set of definitions and differentiations of commonly used terms
- Categorizations: a categorization of skills clusters and groupings at various levels of granularity
- Recommendations: mechanisms for adoption in assessment, hiring, learning and redeployment practices
- Use Cases: examples of how the taxonomy has already been leveraged to lead the Reskilling Revolution

They define competencies as a collection of skills, knowledge, attitudes and abilities that enable an individual to perform job roles. Categorising or grouping skills at different levels increases the efficiency and reach of the taxonomy by allowing employers and education providers to benchmark their own taxonomies against a global framework. Granularity increases with each level, with levels 1-3 remaining as core levels that remain unchanged. Level 4 provides opportunities to add skills as the scope of skills is constantly changing. Level 5 is defined by the end user (i.e. employers, education providers, policy makers). Users can essentially 'plug in' their own taxonomy at level 5.
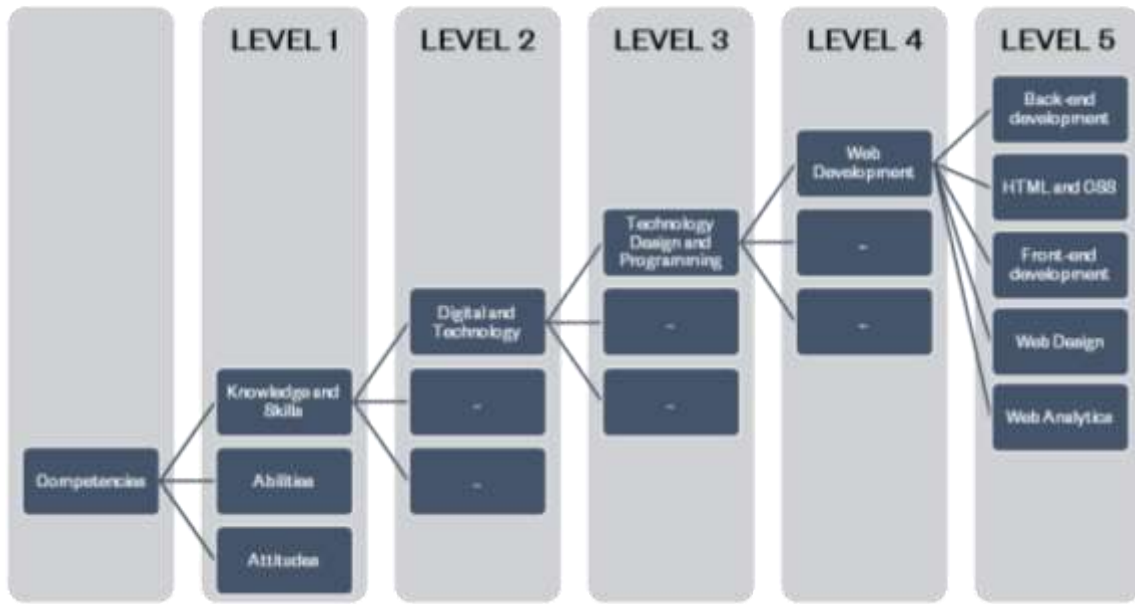
Figure 5. Global Skills Taxonomy: Example on required skills for online application development such as RESPO-VI

2.4.5   Top 10 work skills

The above described taxonomy can be also applied to provide forecasts for emerging skills at global and national scales as well as sectoral levels. These skills forecasts can inform decision-making around reskilling, upskilling and redeployment. The taxonomy may also be leveraged to understand how skills are changing within specific workplaces. According to WEF reports, the top 10 work skills will change over the next decade. Workers and jobseekers will have to be more analytical, critical, systematic, innovative, and creative. They will need to become active lifelong learners, who will be able to handle stress and be ready to adapt to rapid changes.
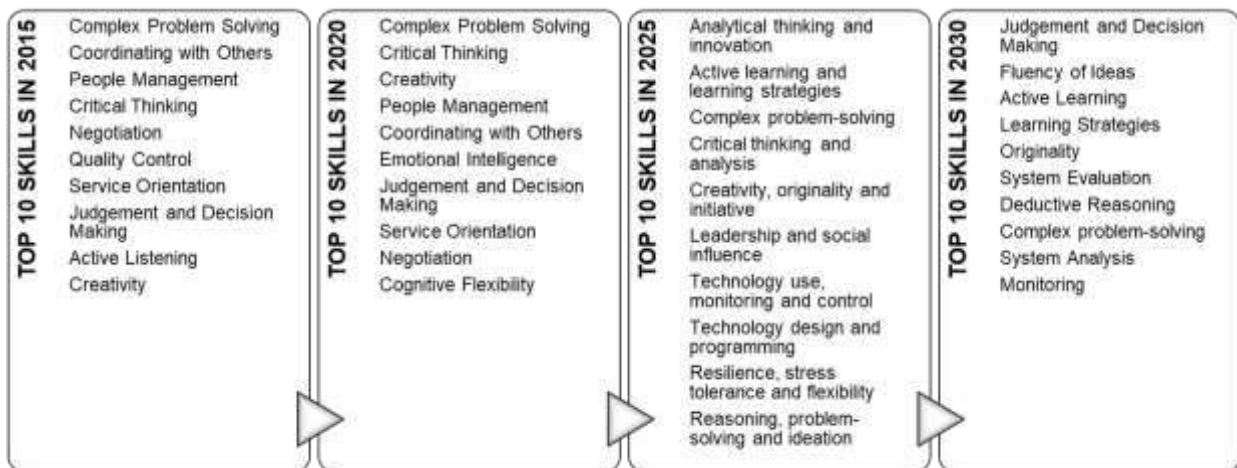

Figure 6. Changing the top 10 skills between 2015 and 2030

3. Key competencies for 21st-century for students

3.1 Different but similar conceptions of key competencies in education

KeyCoNet (http://keyconet.eun.org/) is a growing network of more than 100 organisations funded by the European Commission under the Lifelong Learning Programme to improve the delivery of key competencies in school education. The network uses the European framework on Key Competencies for Lifelong Learning as a reference point, which includes the following 8 key competencies:

- Communication in the mother tongue
- Communication in foreign languages
- Mathematical competence and basic competencies in science and technology (STEM)
- Digital competence
- Learning to learn
- Social and civic competencies
- Sense of initiative and entrepreneurship
- Cultural awareness and expression

These key competencies are all interdependent, and the emphasis in each case is on 7 transversal skills:

- critical thinking,
- creativity,
- initiative,
- problem-solving,
- risk assessment,
- decision taking and
- constructive management of feelings.

The European Council has repeatedly stressed the key role of education and training for the EU's future growth, long-term competitiveness and social cohesion. To achieve this, it is crucial to strengthen the education element of the knowledge triangle "research-innovation-education", starting at an early age - in schools. The competencies and learning habits acquired at school are essential for developing new skills for new jobs later in life. The EU has identified the main challenges facing education systems, which can best be improved by working together in three areas:

- focus on competencies

- high quality learning for every learner

- teachers and school staff.

A more flexible learning environment is required to help students develop different competencies while maintaining basic knowledge. Suggested approaches included new pedagogical methods, cross-curricular approaches to complement and involve learners more in the design of their own curricula. **Literacy** and **numeracy** are essential components of key competencies, as they are fundamental for further learning. Numeracy, **mathematical and digital competencies** and an **understanding of science** are also key to full participation and inclusion in the knowledge society and the competitiveness of modern economies.

Today's jobseekers need to be able to work collaboratively, communicate and solve problems - skills that are developed primarily through social and emotional learning. Combined with traditional skills, these social and emotional skills will equip learners to succeed in the evolving digital economy. WEF listed the following 21st-century skills for students according to three categories:

- foundational literacies: literacy, numeracy, scientific literacy, ICT literacy, financial literacy, cultural and civic literacy;
- competencies: critical thinking and problem-solving, creativity, communication, collaboration;
- character qualities: curiosity, initiative, persistence and grit, adaptability, leadership, social and cultural awareness.

3.2 STEM competencies

The current era is characterised by a growing need for a new set of skills, often referred to as generic or 21st-century skills. These include also STEM skills, which remain a challenge for undergraduates in science, technology, engineering and mathematics, as STEM graduates are sometimes underprepared for what today's professions require. The level of academic achievement of students rarely matches their relevant levels of 21st-century skills and the demands of employers.

There are several studies and research that set the framework for STEM competencies in the 21st century. Many of them also address teaching and learning methods that will need to be transformed in the future to achieve a level of STEM competencies in students that will meet the competence demands of employers and workplaces of the future. Lavi et al. [31] applied the following competence framework for STEM students for their analysis:

- Domain-general skills: complex problem-solving, critical thinking, individual learning, and question-posing.
- Soft skills: creativity, entrepreneurship, collaboration, oral communication, and written communication.
- STEM-specific skills: engineering design, experimenting and testing, STEM knowledge application, and systems thinking.

The United Nations' 2030 Agenda for Sustainable Development, entitled "Transforming our World", established 17 Sustainable Development Goals (SDGs) to tackle global issues such as poverty, climate change, food shortage, the protection of the planet; and to ensure that all individuals enjoy peace, prosperity and quality of life for all. STEM education plays a crucial role in achieving these goals.

Figure 7. The seventeen Sustainable Development Goals (SDGs), source:
https://www.un.org/sustainabledevelopment/blog/2015/12/sustainable-development-goals-kick-off-with-start-of-new-year/

"The core feature of STEM is the use of science, mathematical, technical, engineering knowledge to solve daily or societal problems, making the learning of science, technology, engineering and mathematics more meaningful and contextual. "

Bybee, 2013

However, there are different conceptions of what STEM means in practice, depending mainly on the perspective from which it is viewed in the education system. In general, STEM competencies [32] cover both the 'know-what' (the knowledge, attitudes and values associated with the disciplines) and the 'know-how' (the skills to apply that knowledge, taking account of ethical attitudes and values in order to act appropriately and effectively in a given context).

STEM knowledge includes epistemological knowledge, procedural knowledge and technical knowledge associated with each contributory STEM discipline and how associated ideas, concepts, principles and theories overlap and interrelate. Procedural knowledge provides the foundation for the acquisition, application and practice of STEM skills such as measuring data, ascertaining its' precision, validity and reliability, as well as selecting and displaying it. Technical knowledge is related to the application of knowledge, skills, attitudes and values to a specific field, career or task, such as civil engineering [32]. The UNESCO framework for STEM competencies is summarized in Figure 8.
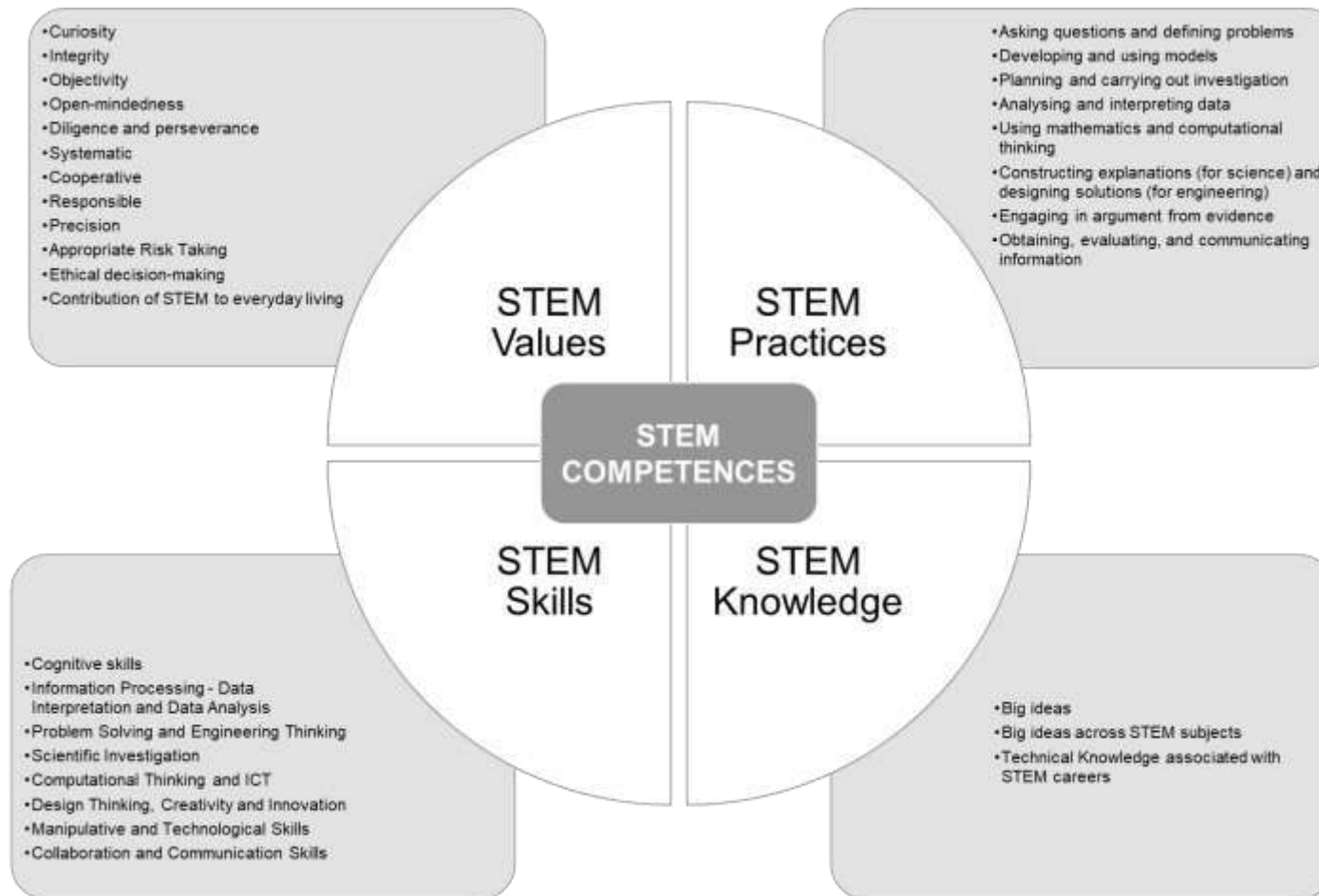
STEM Values
- Curiosity
- Integrity
- Objectivity
- Open-mindedness
- Diligence and perseverance
- Systematic
- Cooperative
- Responsible
- Precision
- Appropriate Risk Taking
- Ethical decision-making
- Contribution of STEM to everyday living

STEM Practices
- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigation
- Analysing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

STEM Skills
- Cognitive skills
- Information Processing - Data Interpretation and Data Analysis
- Problem Solving and Engineering Thinking
- Scientific Investigation
- Computational Thinking and ICT
- Design Thinking, Creativity and Innovation
- Manipulative and Technological Skills
- Collaboration and Communication Skills

STEM Knowledge
- Big ideas
- Big ideas across STEM subjects
- Technical Knowledge associated with STEM careers

Figure 8. UNESCO framework for STEM competencies

The EU STEM Coalition (https://www.stemcoalition.eu/) is a pan-European network working to improve STEM (science, technology, engineering, maths) education in Europe. Their aim to shape STEM education policies and practices that promote economic growth, opportunity and prosperity for all. They provide a unique forum and knowledge hub for data and analysis, exchange of best practices and direct support, from reducing the skills shortage in STEM to fostering new ways of collaboration between educational institutions, businesses and governments. They stress that we need to ensure that STEM subjects in higher education provide students with a wide range of competencies, including important cross-cutting skills such as creativity, flexibility and an entrepreneurial mindset.

ATS STEM Conceptual Framework [33] determined the following eight core STEM competencies, which are basically categories into which the 243 specific STEM skills were grouped, arriving at their conclusions from an analysis of the literature:

- Problem-solving
- Innovation and creativity
- Communication
- Critical-thinking
- Meta-cognitive skills
- Collaboration
- Self-regulation
- Disciplinary competencies

Adams (https://www.weareteachers.com/important-stem-skills-teaching-kids/) listed the following 7 most important STEM skills we should be teaching our students and kids:

- Statistics
- Problem-Solving
- Creativity
- Argumentation
- Intellectual Curiosity
- Data-Driven Decision-Making
- Flexibility

4. Summary of the joint analysis of the questionnaires on competencies needs by companies in Norway and Slovenia

The recruitment challenges such as digitisation, automation and workforce diversity that companies face today are more important and complex than they were a generation ago. As part of the RESPO-VI project, co-funded by the Norway Grants, we have conducted a study among Slovenian and Norwegian companies, the results of which provide valuable insights into the risks that companies are already facing today as they aim to build a better workforce for tomorrow. Higher education institutions also have an important role to play in addressing these challenges, providing formal education and informal training for students who will enter the labour market after graduation.

Through cross-sectoral and bilateral cooperation, the project aimed to identify competency gaps among students in selected study programmes, which will be bridged through the development and deployment of an innovative expert decision support system and individualised interdisciplinary training for STEM students. We will address these challenges by introducing innovative training approaches that will contribute to developing the competencies students need for the jobs of the future. To include relevant competencies in the RESPO-VI database and training for students, we have developed an online questionnaire for companies, the findings of a joint analysis are presented in this chapter.

4.1 Preparation of the questionnaire and implementation of the survey

In order to include the relevant competencies in the database for the RESPO-VI web application and the modular training for students, we have developed an online questionnaire for companies, which is divided into two sections. The first set of questions focuses on the general aspect of employment in companies, while the second set focuses on the development of expected general and specific 21st century competencies in employees and jobseekers, which includes students at the end of their education.

The questionnaires for Slovenian respondents were prepared in an online version. For the Norwegian partners, the Slovenian printed version of the questionnaire was translated into Norwegian and the content adapted to the Norwegian employer market. Invitations to participate in the survey were sent to a mailing list generated by all project partners. **The full analysis of the questionnaires for Slovenian and Norwegian companies was prepared in the Slovene language. Anyone who would like to access the report of this study can contact the project partners (MIITR or MPŠ). In this document, we present the findings of a joint analysis of the questionnaires of the two participating countries.**

Participation in the survey was completely voluntary, and complete anonymity was guaranteed. The collected data were processed and presented at the common RESPO-VI project level,

without the possibility to identify individual respondents and companies. All data collected (responses) are recorded exclusively in the RESPO-VI database.

Table 4. Distribution of completed questionnaires by country of cooperation

Country	Number of invitations sent	Number of completed questionnaires	Percentage of questionnaires completed in relation to invitations sent
Slovenia	25 (large companies) 23 (small and medium-sized companies)	15 jointly	31,25%
Norway	26 (large companies) 32 (small and medium-sized companies)	13 jointly	22,41%

4.2 Analysis of questionnaires for Slovenian and Norwegian companies

4.2.1 Field of activity of the participating organisation

We wanted to invite various Slovenian companies where students of the selected study programmes at the MPŠ (Ecotechnologies, Sensor Technologies, ICT Information and Communication Technologies, Nanotechnologies) and NTNU could find employment. We therefore collected responses from companies in the fields of manufacturing, construction and ICT. As many postgraduate students remain in the academic and scientific spheres after graduation, we also included institutions in the field of education and scientific-technical activities in the study.

4.2.2 General aspect of employment in Slovenian and Norwegian companies

After the crisis in 2021, the Slovenian economy recovered relatively quickly and returned to a stable material and financial situation. The number of people in employment is currently at an all-time high and unemployment is falling. Due to the lack of adequate labour, some companies are already experiencing a negative impact on their production volumes. Moreover, Slovenia is lagging behind the EU average in its transformation towards an innovation-driven, high-productivity economy and in the transition towards a low-carbon circular economy. According to UMAR, the lack of an adequate workforce due to demographic change and the slow response to the need for new skills is also an increasingly serious obstacle to an effective dual transformation of the economy and to raising productivity. One of the recommendations relates to strengthening education and (re)training for the skills of the future, based on modernised and forward-looking

education and training systems. Slovenia's attractiveness for recruiting home and foreign professionals also needs to be strengthened, and this recruitment needs to be targeted.

Employment is a key element of any economy and plays an important role in a country's development. In today's world, businesses face a variety of employment challenges and opportunities. Norway, known for its dynamic and innovative business culture, is no exception. In this chapter, we will present a general perspective on employment in Norwegian companies and analyse key issues related to the current employment situation, the experience and skills of staff for career development, difficulties in filling vacancies and the recruitment of recent graduates. By analysing and answering these questions, we will gain a deeper insight into the recruitment challenges faced by Norwegian companies and understand their strategies and practices to address these challenges. In the following, we will present concrete answers to the questions posed and provide relevant findings on the current employment situation in Norwegian companies.

In general, the reasons why companies find it difficult to recruit the right people can vary, depending on the specific circumstances and needs of a particular company or sector. In some sectors, companies may find it difficult to recruit candidates with certain skills, expertise or experience, while in other sectors companies face a shortage of labour willing to work in certain work environments or working conditions. Labour migration abroad, labour market regulation and education systems can also play a role. Our study shows that Slovenian companies still have a stable climate regarding the current workforce staying in the companies, while Norwegian companies are already showing concerns about the stability of the workforce in the companies. In both countries, companies have not recently been in the process of making redundancies or reducing employment in recent years. Most employees are not seen to be actively looking for new job opportunities in related companies or in another sector, nor are they tempted to work abroad. On the other hand, this may mean that companies do not monitor or have information on the career paths and aspirations of their employees, which is certainly one of the key tasks of HR staff in companies.

Companies in both countries believe that there is significant potential for growth and progression within companies, but that this requires the development of employees' competencies. Companies also feel the need for additional training and development programmes for their employees because of technological change within the company. Only managers are considered to be adequately qualified for their tasks. The majority also believe that HR staff are sufficiently qualified to identify competencies in the recruitment process, where they work with other departments to make decisions about recruiting the right people for the right jobs in the company and with external experts in the process of finding and hiring the right people.

In Slovenia and Norway, companies believe that people are still applying for their vacancies. The level of skills of jobseekers in Slovenia is sufficient to do the jobs they are looking for. Slovenian jobseekers are expected to have the required work experience, while in Norway jobseekers in several cases did not have the required work experience. In both countries, job applicants are sufficiently motivated for their chosen positions and tasks and find the working conditions and working hours attractive. However, what is noticeable in both countries is that the financial conditions do not meet the wishes of all candidates. Slovenian companies are satisfied with the current recruitment procedures, while Norwegians believe that the recruitment and selection process could potentially be improved.

Companies in Norway and Slovenia are already facing challenges in finding the right people for the right jobs. They are increasingly realising that there is a shortage of people on the labour market with the right skills for their specific vacancies. This reflects the existence of a gap between the needs of companies and the skills available on the labour market. Slovenian companies also notice that jobs have become more difficult and technically demanding. Companies have mostly formal guidelines in place for the training and development of their employees, but there is room for improvement in this management process, in particular through the use of various tools to monitor the development and assessment of employees' competencies within the company. The use of such tools could facilitate the currently difficult access to employment information in the sector in which the company operates.

Companies also face challenges in replacing jobs quickly and in carrying out the tasks defined for the job. In these cases, Slovenian and Norwegian companies first turn to the company's existing workforce, which is assigned additional responsibilities in the form of extra work. Accordingly, the company has to adapt the organisation of work and redistribute its employees among the jobs within the organisation. In order to move from one job to another, employees need to develop new skills and knowledge, they need to become versatile, which is one of the silent competencies that companies really need from their employees, but which is not talked about much, as it often means extra workload and exhaustion for employees. Norwegian companies also often outsource work when there are no candidates for a vacant position, but this is not yet common practice in Slovenia. In both countries, however, companies hardly decide to introduce job automation processes.

Companies often take on additional recruitment activities, such as using other recruitment channels and intensifying their search for candidates in other sectors and in the wider region (including abroad). They also often choose to recruit young people who are leaving education and entering the labour market. Looking at certain trends, it could be said that more and more companies are now choosing to recruit young people immediately after they have completed their studies or other certifications. This can be attributed to several factors, including the development of new technologies and the rapidly changing needs of the labour market. Young people often have the latest skills and experience needed to perform certain jobs and are often seen by companies as innovative and flexible employees who can quickly adapt their work to new requirements. Slovenian companies see young people as more adaptable, better motivated and success/progress oriented and more accessible on the labour market, while better analytical skills and better absorption and processing of information are slightly less important factors. The opposite is true for Norwegian companies, which value young people for their better analytical and problem-solving skills, their better ability to absorb and process information, their better motivation and success/progress orientation, and their ability to innovate, come up with new ideas and solutions. Less important are the qualities of flexibility and value for money. We conclude that employing recent graduates brings several benefits and advantages for companies. Problem-solving skills, the ability to absorb and process information, motivation, innovation and adaptability are key qualities that they bring to the workplace. Companies need to properly value these strengths and capitalise on them through appropriate support and development programmes for recent graduates.

4.2.3 Companies' expectations on the development of 21st century competencies in the labour market

Businesses of the future will need a wide range of 21st century competencies to adapt effectively to a rapidly changing business environment and technological advances. Some of these competencies are: digital literacy, critical thinking, effective communication, collaborative skills, creativity and innovation, knowledge acquisition, distance learning, intercultural skills, leadership skills and agility as the ability to adapt and adjust to new situations and demands and to accept change (adapted from ChatGPT response). Training and developing the competencies of the workforce is crucial to the success and competitiveness of businesses in the modern economy. In this context, it is important to understand whether companies can access the right kind of training to help them develop their employees' competencies in different areas. In our analysis, we found that more than 90% of Slovenian companies have access to training that enables employees to adapt to digital working. They also have good access to training for managing work processes, technologies and employees. They have slightly less access to training on career management. The same trend can be seen in Norwegian companies. This is where companies can turn to advanced digital tools and technologies that allow recruiters to monitor the career development of their employees, especially in terms of developing and assessing the skills needed to perform successfully and well in the jobs to which they have been assigned or to which they can be promoted.

When analysing the questionnaire data, we found that Slovenian companies consider that additional training to develop new skills or complement existing ones is needed for all three groups of employees, but that those with a low level of education, who have completed primary school or lower and secondary vocational education, still rank first. The results of the Norwegian questionnaire show that employees with low educational qualifications have the highest perceived deficiencies. They are followed by employees with secondary education, while employees with higher education have the lowest perceived competence gaps. This could be due to the limited educational background and the lower exposure to higher levels of competencies of the lower educated staff. It is therefore crucial that companies focus on the individualised development of training and education programmes that will enable employees to acquire the necessary competencies to perform their tasks at a high level according to their background, experience and needs. Based on these results, we recommend that the company develops and implements a variety of training and education programmes that are tailored to the needs of each educational group. In-house training, mentoring, financial support for further training and encouraging participation in professional communities are some of the measures that a company can use to improve the competencies of its employees.

Furthermore, we have identified the importance of competencies for employees in those positions in the company that require a higher level of education, i.e. level VII to VIII (university programmes, Master of Science, Ph.D.). The results of this analysis show that there is a diversity of opinions between Slovenian and Norwegian companies regarding the importance of competencies for employees in positions with level VII to VIII. When interpreting these results, it should be borne in mind that these are subjective opinions of the respondents. Organisations and companies should take these different views into account and consider how they can develop and strengthen important competencies for success in their workplaces. In addition, it would be useful to conduct further research and analysis to gain additional insights into the relevance and development of competencies in employees in different workplaces. We have made a cross-

section of the importance of competencies for Slovenian and Norwegian companies. We found that four competencies (innovation, management and planning of processes, technologies and people, adaptation to change and ability to manage uncertainty) are important for companies in both countries, while for the remaining competencies companies gave different levels of importance for employees in the future. Figure 9 shows a cross-section of the importance of the selected competencies for companies in both countries.

The last part of the analysis shows that Slovenian companies are still not the most favourable to teleworking and virtual working for all employees whose workplace allows it. The digitalisation deficit is also evident in the reluctance to use workforce analytics and databases to predict and monitor employee skills gaps. The same is true of automation and the replacement of human labour by technology, but there is an awareness that automation and artificial intelligence will influence future needs for the development of new skills in the workforce. Companies do not significantly consider local availability of skills when developing their business and recruitment strategy, but they are aware that environmental issues, often linked to the local environment, have a significant impact on the company's business management planning. Nor do they believe that working with policy makers can help them in the future to address skills gaps in the workforce of the sector in which they operate. They value more than policy makers the cooperation with educational institutions, which can also provide employees with training opportunities for retraining and lifelong learning.

SLOVENIA

- Creativity
- Systemic and analytical thinking
- Critical thinking
- Self-initiative and self-management
- Written and oral communication skills in a foreign language
- Information management and processing (interpretation and analysis of data)

- Innovation
- Managing and planning processes, technologies and people
- Adapting to change
- Ability to manage uncertainty

NORWAY

- Cooperation and networking
- Media literacy
- Advanced computer/IT skills (e.g. artificial intelligence)
- Safety assurance
- Business and entrepreneurial skills
- Social responsibility and inclusion

Figure 9. Four intersectional competencies of Norwegian and Slovenian companies and selection of TOP6 other competencies by country.

4.3 Conclusion

In the future, a variety of factors will influence job opportunities in companies, including technological advances that will bring new types of jobs and occupations. Companies will need professionals with universal skills and the ability to adapt quickly to technological change. Demographic demands such as longer working ages, an ageing workforce and an increase in the number of 'millennials' in the labour market will affect the composition of the workforce and the different skills mix between different generations of employees. Globalisation will trigger even more competition between companies, bringing new opportunities and requiring continuous improvement in business processes. The way companies are managed and operate will also be influenced by the need for sustainable development and social responsibility. This will create new job opportunities requiring increasingly specific skills. On the one hand, companies will have to struggle to attract and retain the best employees and, on the other, they will have to provide adequate education and training for their employees.

In this study and in the analysis of the questionnaires filled in by the companies, we have jointly concluded that the competencies selected and examined are relevant for modern society and the economy. We have taken into account the findings of the recommendations of the EU (European Agenda on Skills, Digital Education Action Plan 2021-2027, European Green Plan, New European Research Area, Eurostudent), WEF and UNESCO. We have also included among the competencies that will be required by the new jobs of the future and as already identified by the funding programme, Norway Grants. Raising awareness of education and promoting the development of these competencies will contribute to better preparing individuals for the challenges and opportunities that the modern environment brings. From the analysis of the questionnaires, we compiled a list of the TOP10 competencies highlighted by both Slovenian and Norwegian companies and include them in the database for the RESPO-VI application. The list includes general and specific competencies that employers perceive as most important and that the industry needs now and in the future. This list is available online in Slovenian and English versions for later re-use in other related projects or for the introduction of the RESPO-VI application in other HEIs or for policy makers. Based on the selected competencies, we will develop and deliver modular training for STEM students, using the developed application to monitor the development of these competencies during and after the training. The experience gained during the training and the validation of the RESPO-VI application will further improve the level of transferable skills acquired, while allowing formal education and informal training programmes to be complemented with the current and future needs of employers and employees.

It should be noted that the results of this survey are based on self-reporting by some individual employees, which may introduce subjectivity and personal selection bias. It is also important to take into account other factors such as education, training and experience of employees that may influence the development of these competencies. Other research methods, such as interviews or observation of employees' work, would also be useful to get a more complete picture. Nevertheless, the results of this questionnaire can serve as a starting point to further understand the competence development needs of the company's employees and the future needs of the labour market.

5. Comparison of selected study programmes at NTNU and MPŠ and the KOC-TOP competency model as a basis for selecting students' key 21st-century competencies

5.1 KOC-TOP competency model

In 2018, MPŠ established a Career Centre, which successfully coordinates the Competence Centre for the Factories of the Future KOC-TOP, from which the idea of developing an online application to help select the optimal training for employees in the factories of the future emerged. A competency model for new technologies in the factories of the future has also been developed and tested by several companies within the KOC-TOP. In this area, the MPŠ is cooperating with the SRIP-TOP centre, which links more than 100 Slovenian factories of the future. By developing additional functionality of the expert system and adapting the competency model to the learning outcomes of the study programmes and the needs of the students, considering the labour market, the MPŠ will gain a new digital tool that will support the career progress of its students at postgraduate level and university teachers and facilitate the transition to the labour market. This approach will help to complement formal education with various forms of non-formal training, tailored to each individual student. This is also underlined by the Europe 2020 strategy. By linking formal education and non-formal training, we will help to bridge the competence gaps that exist between the current education and research process and the industry into which our master's and PhD students are entering.

Within the Competence Centre, we developed a Competence model for Advanced Technologies in Factories of the Future (KOC-TOP Competence model). The list of competencies included in the KOC-TOP competence model is summarized in Figure 1.

The preparation of the competence model was based on the needs of the KOC-TOP Competence Center industrial partners, SRIPs action plans and the educational process in Slovenia. The competence model includes the knowledge, skills, expertise, abilities, and other characteristics that are required for successful performance in a particular workplace. The purpose of the competence model is to ensure that employees do the right things and do them successfully and bring maximum added value to their work and consequently to business success. The model describes 1) general competencies that relate to the company culture and values; 2) specific vocational competencies common to the particular profession; 3) key competencies that are most relevant to each job and represent a competitive advantage for the company. Industrial partners of the project have made an analysis of key competencies for a specific workplace. A set of reference groups for competencies were identified as depicted in Figure 1.
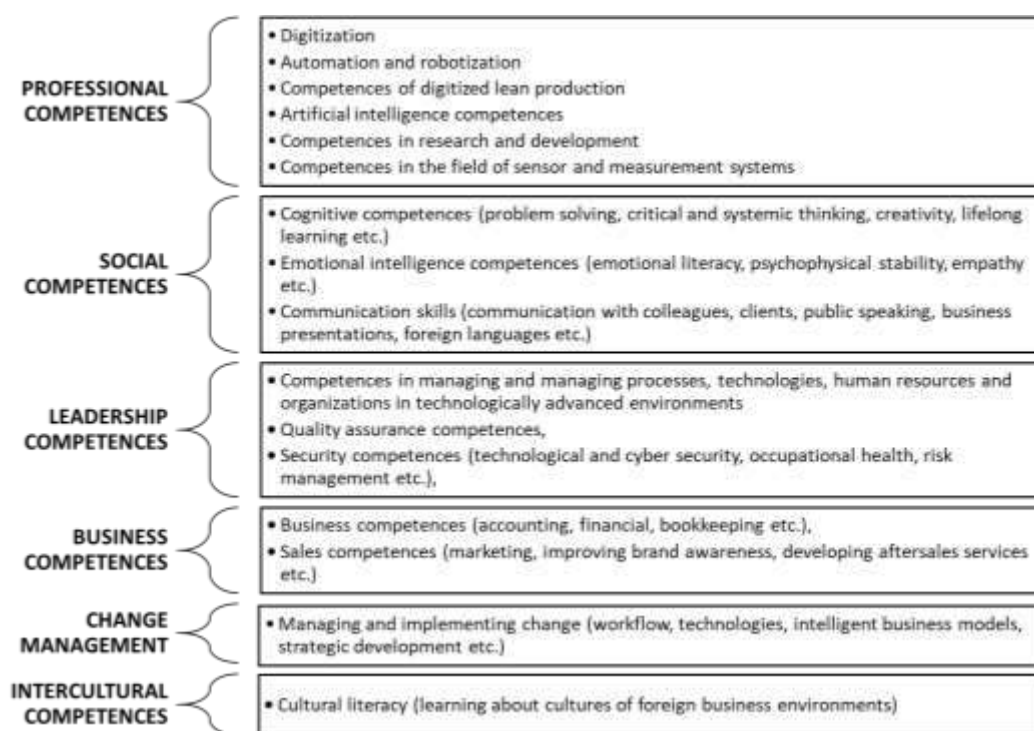
Figure 10. Competence list in the KOC-TOP competence model (Source: Abina et al. 2022)

The definition of general and specific competencies or skills in the RESPO-VI database will be based on the current KOC-TOP competency model, which has been developed by the KOC-TOP in cooperation with several Slovenian companies. We will update it in line with the learning outcomes and competencies of the curricula of the selected study programmes of the participating HEIs in Slovenia (MPŠ) and Norway (NTNU). We will also consider the findings of the recommendations of the EU (European Skills Agenda, Digital Education Action Plan 2021-2027, European Green Deal, New European Research Area, Eurostudent), WEF and UNESCO. We will also include competencies that will be required by new jobs in the future, as already identified in the Norway Grants programme call, such as creativity, innovation, empathy, critical thinking, problem-solving, self-management and IT. The project also prepared a list of general and specific competencies needed for a faster, including digital, transition tailored to the needs of companies in Slovenia and Norway (see infographic produced by RESPO-VI project). For this purpose, a questionnaire was prepared, which was divided into several sets of skills and competencies and it was distributed to various large companies, SMEs, HEIs and institutes. This will allow companies and the labour market the opportunity to co-shape future study programmes and additional informal training to accelerate digital transformation and green employment. The competencies and skills identified in this study will be integrated into the development of the database needed to build and operate the RESPO-VI expert decision support system. Furthermore, the selected list of competencies will be considered when updating the KOC-TOP competency model. Thus, the existing KOC-TOP competency model will be adapted to the needs of employers in Slovenia and Norway as well as to the specifications of the selected study programmes to better connect qualified STEM students with potential employers. This experience will further improve the level

of transferable skills acquired while allowing the education and training programme to be complemented with current and future workforce needs.

5.2 Selected MPŠ study programme

The Jožef Stefan International Postgraduate School (MPŠ) was established in 2004 as an independent higher education institution. The Jožef Stefan Institute provides the central research and educational basis, whereas its partners, such as invited research institutes, industrial and other enterprises also contribute their knowledge and innovation capacities for solving developmental problems.

MPŠ offers four study programmes in the most propulsive fields of natural science and technology:

- Nanosciences and Nanotechnologies,
- Information and Communication Technologies,
- Ecotechnologies,
- Sensor Technologies.

Among the MPŠ study programmes, the doctoral study programme Ecotechnologies has been selected as the most suitable for cooperation with NTNU.

The doctoral programme in Ecotechnologies was developed to provide expert knowledge in the field of ecotechnologies. The study programme is aligned with the R&D projects of the MPŠ and its partner research institutes and industry. The Slovenian sustainable development strategy includes the integration of environmental, technological, economic and social goals, especially in production and consumption. Therefore, it's important to plan, develop and disseminate the use of eco-technologies ("eco" means both ecological and economic) and to implement systematic sustainable market strategies to develop more favourable consumption trends. The essential components of eco-technological approaches are new processes and products that involve greater efficiency in the use of raw materials and energy, the minimisation and recycling of waste, the reduction of negative environmental impacts of production and transport, and the systematic improvement of the vulnerable environment.

This study programme offers the acquisition of knowledge and the development of skills for competent research, forming international relationships, and for the management of sustainability-oriented development, and the transfer and application of ecotechnologies.

The emphasis is on the threefold ability to:

- broaden and deepen the scientific content, methods and techniques in selected areas of natural, technical, engineering and information sciences that support the strategic selection, development, transfer, optimisation, use and control of selected eco-technologies to increase economic efficiency while promoting broader societal interests in sustainable development;
- the development of skills and capabilities to improve the quality of processes, products and services and to increase added value, pursuing excellence and maximising the implementation of sustainable development principles;

- the development of an integral process of thinking which surpasses individual areas and develops multidisciplinary communication skills for dealing with experts from other disciplines and subject areas, comprehensive definition of problems, systematic approaches solving complex problems through teamwork, decision-making under conditions of uncertainty, and long-term target-oriented strategic planning.

The most important general competencies gained from this study programme include:

- mastering the methods and techniques of scientific research in the field of ecotechnologies;
- a comprehensive definition of problems, systemic approaches and solving complex problems;
- ability to work independently and in groups;
- research and development work and the ability to integrate into international connections;
- development of an integral way of thinking that goes beyond individual areas;
- ethical reflection and commitment to professional ethics and regulations.

Some of the employment opportunities for the graduates can be found in the following professions:

- Academic Researcher;
- University Professor;
- Industry R&D;
- Environmental Industry;
- Process Industry;
- Expert in Environmental Agency;
- Science Journalist in a Newspaper;
- TV Science Journalist;
- Radio Science Journalist;
- City administration.

As this study program offers a large list of elective courses, the following have been selected as the most relevant to cooperation with NTNU:

- Tools for the Environmental Quality Control;
- Economics and Society;
- Biomonitoring;
- Environmental Physics;
- Colloidal Biology.

5.3 Selected NTNU study programme

The Department of Civil and Environmental Engineering provides competencies and technological solutions within our areas of expertise for application in both the public and private sectors. Students and researchers graduating from our programs provide our partners with expertise and skills in the areas of civil and transportation engineering, structural engineering, water and wastewater engineering, and hydraulic engineering. The 3-year bachelor study program in Civil Engineering and the 5-year integrated master's study program in Civil and Environmental Engineering are the main study programs at the department. The department offers both English and Scandinavian-speaking study programmes.

Among English-speaking study programmes, the most popular ones are 2-year master's study programmes that require a bachelor's degree or master's degree.

- Hydropower development;
- Geotechnics and Geohazards;
- Coastal and Marine Engineering and Management (Comem);
- Cold Climate Engineering;
- Project Management (PROMAN).

Scandinavian-speaking study programmes provide education at different levels.

5-year master's study programmes include:

- Civil and Environmental Engineering;
- Engineering and ICT.

3-year bachelor study programmes include:

- Civil Engineering;
- Vocational Teacher Education, study profile building and construction.

3-year experience-based part-time master programmes include:

- Road, Railway and Transport Engineering.

2-year master's study programmes include:

- Civil and Environmental Engineering;
- Property development and management.

Among these study programmes, the programme Civil and Environmental Engineering was selected as the most suitable for cooperation with MPŠ.

The most important general competencies obtained in this study programme include:

- Building roads and bridges;
- Building drinking water and wastewater systems;
- Building energy supply systems;
- Building house construction and urban environment;
- Operating systems that make the society work: roads, bridges, drinking water, wastewater, energy supply, house construction and urban environment.

Some of the employment opportunities for the graduates can be found in the following professions:

- Road construction;
- Drinking water systems;
- Wastewater systems;
- Energy utilities;
- Construction firms;
- Urban planning;
- City administration;
- Environmental Industry;
- Process Industry;
- Expert in Environmental Agency.

As this study program offers many elective courses, the following have been selected as the most relevant to cooperation with MPŠ:

- Programming and numerics;
- Property development;
- Building process Basic course;
- Masonry structures;
- Civil engineering;
- Project planning and analysis;
- Energy use in buildings;
- Design management;
- Production management in BA projects;
- Building simulation;
- Transformation and new use of existing buildings;
- Concrete technology 1;
- Experts in teams (Various Topics).

5.4 Analysis of selected study programmes

Although the observed study programmes are from different study fields and formally different, there are many similarities in the approach as well as in competencies and skills addressed by the study programmes.

The Norwegian master-level study programme in Civil and Environmental Engineering takes two years, while the Slovenian doctoral-level study programme in Ecotechnologies takes three years.

For the comparative analysis of these selected study programmes we first collected and compared basic characteristics of the observed study programmes in Table 1.

Table 5. Basic characteristics of the observed study programmes

	Study programme I	Study programme II
Name of study programme	Civil and Environmental Engineering	Ecotechnologies
Name of organisation in English language	Norwegian University of Science and Technology	Jozef Stefan International Postgraduate School
Faculty/Department	Faculty of Engineering, Department of Civil and Environmental Engineering	/
Type of qualification	Master Studies	Doctoral Studies
Duration in years	2	3
ECTS	120	180
International programme	YES	YES
Language of instruction	Norwegian, English	Slovenian, English
Distance learning	NO	NO
Name of educational qualification	Master of Engineering	doktor znanosti
Qualification EHEA level	Second Cycle	Third Cycle

ISCED 2013 (broad field)	85 Environmental protection	85 Environmental protection
Assessment (a brief description of grading scales)	letter grading system ABCDE	ECTS 1-10 scale
General competencies (up to 5)	Building roads and bridges	Mastering the methods and techniques of scientific research in the field of ecotechnologies
	Building drinking water and waste water systems	Comprehensive definition of problems, systemic approaches and solving complex problems
	Building energy supply systems	Ability to work independently and in groups research and development work and the ability to integrate into international connections
	Building house construction and urban environment	Development of an integral way of thinking that goes beyond individual areas
	Operating systems that make the society work: roads, bridges, drinking water, waste water, energy supply, house construction and urban environment	Ethical reflection and commitment to professional ethics and regulations
Employment opportunities (up to 10 workplaces)	Road construction	Academic Researcher
	Drinking water systems	University Professor
	Waste water systems	Industry R&D
	Energy utilities	Environmental Industry
	Construction firms	Process Industry
	Urban planning	Expert in Environmental Agency

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	City administration	Science Journalist in a Newspaper
	Environmental Industry	TV Science Journalist
	Process Industry	Radio Science Journalist
	Expert in Environmental Agency	City administration

From Table 5, there are several similarities between the compared study programmes. Although the Norwegian study programme has a stronger focus on environmental applications in building and construction engineering, the Slovenian study programme has a stronger focus on environmental applications in science and industry.

Therefore, there is a certain overlap between the general competencies, although the Norwegian competencies are more specific and the Slovenian ones broader. Also, there is an overlap between the employment opportunities between the observed study programmes. It is reasonable that the doctoral study program provides more employment opportunities in research and academia, while the master study programme offers more employment opportunities in various fields related to environmental applications in building and construction engineering. Still, there are many jobs listed in only one study programme that would also be accessible with a degree from the other study programme. For example, Slovenian graduates could easily find employment in energy utilities or water-related systems.

In the following, we focus on these overlaps in order to extract more possibilities for cooperation between the two study programmes.

Table 6 provides an overview of the specific competencies that are addressed by the selected courses in both observed study programmes.

Table 6. Specific competencies addressed in observed study programmes

Course title at the HEI	ECTS	HEI	Up to 5 specific competencies				
Tools for the Environmental Quality Control	10	IPS	mastering and understanding the basic characteristics of contaminated and degraded environments and remediation planning	characterization and identification of degraded and contaminated sites and implementation of control measurements (monitoring)	use of databases and environmental modeling	understanding of strategic assessments of environmental assessments	understanding and analysis of ethical aspects of practices, institutions and evaluations related to the environment and systemic understanding of dynamic processes in nature and society
Economics and Society	5	IPS	mastering of methods and techniques of scientific research work in the field of sustainable development, economics, national and business innovation management				

Biomonitoring	5	IPS	Understand the conditions in terrestrial and aquatic ecosystems in connection with anthropogenic influences with the help of plants, animals, fungi, microorganisms as indicator organisms	master the principles and significance of the use of organisms for monitoring the state of the environment in aquatic and terrestrial ecosystems compared to physical and chemical measurements.	Understand different ways (response, battery, monitors) and levels (cell, organism, population, structure, function, production) of using bioindicators to track the most frequent air pollutants entering natural and anthropogenic terrestrial ecosystems.	Understand the importance of human biomonitoring in the context of external and exposure assessment in humans and environmental health impact assessment	
Environmental Physics	5	IPS	apply knowledge from environmental physics in research work				

Colloidal Biology	5	IPS	acquiring abilities of solving complex problems in bioreactor and ecoremediation systems, environmental measurements and analysis of materials	integration of acquired knowledge of colloidal interactions in biosphere into the doctoral research work	mastering encapsulation techniques for cells		
Programmering og numerikk	7,5	ID	explain central concepts and mechanisms in procedure-oriented programming	derive the result of running small programs and functions	explain number representation, precision of calculations and the operation of central numerical methods Skills	use suitable tools for writing and running Python programs - apply appropriate data structures, control structures and division into functions and modules to create well-structured and functioning code	apply basic numerical methods in solving computational problems, and import and use numerical library functions into Python
Eiendomsutvikling	7,5	AD	has a good understanding of the various phases in the development and how various	have a good understanding of the qualitative, architectural and locational aspects of property	can work on an independent basis with the development of real estate projects and carry out the	can use relevant technical terms and expressions related to property development and communicate	has a well-developed understanding of professional and ethical integrity

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			factors affect process and result	development, and the context in which property development projects take place	necessary financial and market assessments of real estate projects and weigh these against other important framework factors	results from independent project work both in writing and orally in a structured and clear way	and critical reflection
Byggeprosess Grunnkurs	7,5	IBM	can use tools to create a budget	can use tools to calculate tenders	methods for analyzing profitability in construction projects and various HSE indicators	can understand how a building process develops from a need to an actual building	understand technical terminology used in the building process
Murkonstruksjoner	7,5	IBM	A practically applicable understanding of requirements, stresses and building technical, building physical and material connections as a basis for the design of building parts and buildings that meet requirements	Good background for communicating with other disciplines (architect, plumbing, electrical, fire etc) involved in the design, construction and operation of buildings.			

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			for reliability, functionality and sustainability.				
Anleggsteknikk	7,5	IBM	Understanding of the connections between the material properties of the rock mass, driving methods, time consumption, costs.				
Prosjektplanlegging og analyse	7,5	IBM	can understand the importance of projects' early phase				
Energibruk i bygninger	7,5	EPT	The student must have competence in calculating and evaluating buildings' power and energy needs as well as the achieved indoor climate.	The student must be able to use this competence to choose solutions for building constructions, energy supply and technical installations that provide an optimal indoor climate in a resource-wise and			

				financially sound manner.			
Prosjekteringsledelse	7,5	IBM	Understand the importance of professional management of the design process.	Understand the importance of framework factors such as cost, time and quality.	Understand the importance of planning in relation to the building's suitability for its purpose.		
Produksjonsledelse i BA-prosjekt	7,5	IBM	Insight into the connection between building type, construction method, time consumption, costs, quality and HSE.				
Bygningssimulering	7,5	IBM	an understanding of the background for building simulation	an understanding of requirements for thermal and visual comfort and indoor climate, and of their relationship to energy use in buildings	an understanding of how the building shell and systems behave under dynamic conditions	an understanding of integrating passive measures and systems for renewable energy production in a building model	

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Transformasjon og ny bruk av eksisterende bygninger	7,5	IBM	Understand the principles for sustainable conservation and development of existing buildings	methods and regulations related to energy, environment and waste, fire protection / safety, energy efficiency, universal design to extend the building's life cycle	special challenges in cost calculation, tender documents, technical systems in old buildings, etc environmental	social conditions in the management of the conversion / transmission of buildings buildings	
Betongteknologi 1	7,5	KT	basis for the use of concrete, with an emphasis on the requirements and possibilities provided by the Norwegian Standard	use of concrete based on fundamental knowledge of component materials and composites			

Table 6 demonstrates a wide variety of specific competencies that are addressed by both study programmes. The comparison of these competencies allows for the determination of common points where it makes the most sense to address students of both study programmes within this project. This analysis also represents a starting point for the development of content that will address those competencies that have been found the most useful in both observed countries.

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Conclusions

The European Union's policies and guidelines highlight skills as key to sustainable competitiveness, resilience and social inclusion. This is also the key of the European Skills Agenda, which focuses on investing in lifelong learning (up-skilling and re-skilling) to sustain recovery from the coronavirus pandemic and to meet the challenges of a digitalising world and a greening economy. As these changes are already underway and accelerating, Europeans will need to acquire new skill sets or improve their existing skills to better adapt to the rapid changes ahead and to be successful and satisfied in the future labour market.

Knowledge and skills have become key factors for individual well-being and economic success in the 21st century. Without investing in people's knowledge and skills, we cannot expect a high quality of life in society, technological progress and economic competitiveness and innovation. Countries need to focus on creating the right mix of skills and ensuring that these skills are fully exploited in the labour market.

We compared the competencies highlighted by the different strategies and guidelines (EU, OECD, WEF, UNESCO, National authorities, etc.) with those identified as important by the companies through the questionnaires. The comparative analysis led to the selection of key competencies that were also compared with the competencies and learning outcomes of the selected study programmes of the participating HEIs and the competencies identified in the KOC-TOP competency model for the factories of the future.

The analysis of the selected Slovenian and Norwegian study programmes demonstrates the differences between the approaches to education in each country. Common competencies have been determined and extracted both as an opportunity for stronger cooperation between the study programmes in the observed countries as well as an opportunity for competencies development to better fulfil the needs of students and their perspective employers. The identified competencies were considered when preparing the list of students' key 21st-century competencies for RESPO-VI application as well as when we will develop and implement modular training for STEM students.

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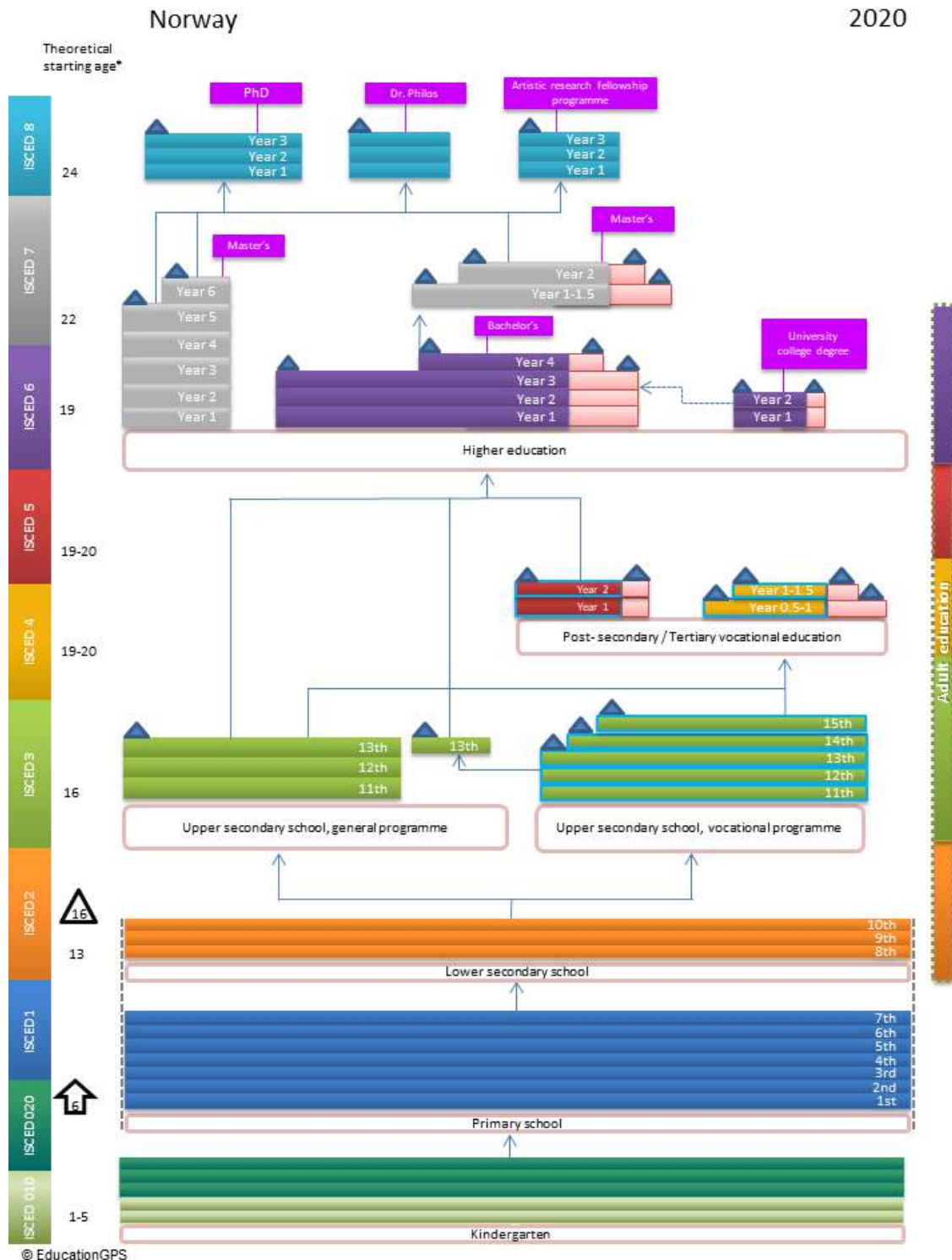# Appendix 1: Diagram of the education system in Slovenia

Source: https://gpseducation.oecd.org/CountryProfile?primaryCountry=SVN

Appendix 2: Diagram of the education system in Norway

Source: https://gpseducation.oecd.org/CountryProfile?primaryCountry=NOR