KNOWLEDGE SUPPLY CHAINS

Matevž
Obrecht

Tina
Cvahte Ojsteršek

Mateja
Čuček

Martin
Fale

Nena
Orel Šanko

Polona
Vičič

Bojana
Slomšek Šlamberger

Lazar
Pavić

Enhancing Wisdom of Green and Digital Transition

University of Maribor Press

Knowledge Supply Chains

Enhancing Wisdom of Green and Digital Transition

Authors
Matevž Obrecht
Tina Cvahte Ojsteršek
Mateja Čuček
Martin Fale
Nena Orel Šanko
Polona Vičič
Bojana Slomšek Šlamberger
Lazar Pavić

July 2025

Table of Contents

KNOWLEDGE SUPPLY CHAINS:
ENHANCING WISDOM OF GREEN AND DIGITAL TRANSITION
M. Obrecht et al.

University of Maribor Press

1   Introduction

Today, the logistics sector faces many challenges. One of them is the fact that logistics accounts for approximately 24% of CO_2 emissions globally, and it is predicted that the share could even grow to 40% by 2050 (*Climate Change*, n.d.). An even more significant challenge is that employees in the logistics sector, decision-makers, and logistics graduates sometimes do not have sufficient knowledge to deal successfully with the consequences of climate change, which is slowly becoming one of the priorities of business and logistics organisations. The ELA Standards 2014 (ELA Qualification Standards, n.d.) are the fundamental starting point for personnel training in logistics, whereby study programmes are continuously renewed and updated. The key question is how to successfully address this challenge by ensuring that the competencies crucial for the simultaneous green and digital transition in the field of logistics and supply chains are quickly integrated into university programmes and, at the same time, effectively transferred to decision-makers, employees in the field of logistics, and all other interested parties.

The key to success is developing a system that responds quickly to the challenges and changing needs of the environment and offers interdisciplinary knowledge for logistics and supply chain professionals in the future. The fundamental areas of education are green and digital logistics and supply chains of the future as key guidelines for the European Union's (EU) sustainable development based on a simultaneous green and digital transition (Joint Research Centre, 2022). In this way,

higher education institutions in the field of logistics and supply chains can enhance their role and purpose, because by demonstrating quick adaptability, resilience and responsiveness to the needs of the environment, they contribute significantly to the cohesiveness and balanced, sustainable development of the sector and of the society as a whole.

Logistics and supply chain employees will have to actively develop the competencies that enable them to function sustainably in the business environment and everyday life. Competencies for sustainable development encompass cognitive, affective, motivational and volitional elements and, therefore, cannot be simply learned (UNESCO, 2017). In 2017, UNESCO formulated eight key competencies for sustainability. These are (Figure 1):

−   systems thinking competency, which represents the ability to recognise and understand relationships, analyse complex systems, think about how different systems are embedded in different areas and how to deal with potential uncertainty;
−   anticipatory competency, which includes the ability to understand and evaluate the future (possible, probable and desirable changes), create one's vision for the future, use the precautionary principle, assess the consequences of various actions and deal with assessed risks and possible changes;
−   normative competency, which includes the ability to think about norms and values that are the basis of individual actions, the ability to negotiate sustainable values, principles and goals in the context of different and often conflicting interests, uncertainties and contradictions with the ultimate goal of reaching compromises;
−   strategic competency, which represents the ability to jointly develop and implement innovative measures that promote sustainability at a local or broader level;
−   collaboration competency, which is manifested in the ability to learn from others, in understanding and respecting the needs, views and actions of others (empathy), the ability to understand, connect and be sensitive to others (empathic leadership), in resolving conflicts in groups, together with the ability to solve potential problems in a participative and collaborative way;

- critical thinking competency, which includes the ability to recognise norms, practices and opinions, to reflect on one's values, perceptions and actions, together with the ability to take positions in the discourse on sustainability,
- self-awareness competency, which represents the ability to reflect on one's role in the local community and (global) society, to constantly evaluate and consequently motivate one's actions, along with actively dealing with one's feelings and desires; and

integrated problem-solving competency, which represents the general ability to use various frameworks to solve complex problems in the field of sustainability and develop feasible, inclusive and fair options for solutions that promote sustainable development by including all previously mentioned competencies
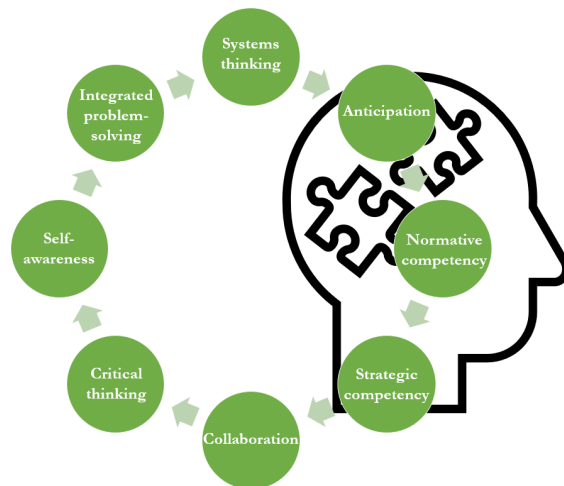
Figure 1: Eight key competencies for sustainability
Source: Own work.

The starting point for the development of key competencies for sustainability is the field of Education and Training for Sustainable Development (abbreviated: ESD), which emphasises the use of innovative pedagogical approaches in knowledge transfer, raises learners' awareness of the importance of sustainability, and guides them toward taking a more active role in the transition to a sustainable society. The umbrella guidelines for the implementation of ESD in practice are provided by a new implementation framework: "Education for Sustainable Development for 2030" (ESD for 2030), which was approved at the 74th session of the General

Assembly of the United Nations (UNESCO, 2022). The new implementation framework focuses on highlighting the role of education in providing the knowledge needed to achieve sustainable development goals. The focus is on responsibility for the future and future generations and the importance of ensuring changes in operations, whereby the continuous and coordinated operation of all countries, various stakeholders, non-governmental organisations, and partners at the regional and global levels is of key importance.

1.1   Purpose, Objectives, Research Questions and Methods of Work

The scientific monograph aims to provide a systematic insight into the knowledge, skills and abilities that employees in the field of logistics and supply chains will need for a smooth green and digital transition of the entire sector to society 5.0. The scientific monograph is primarily aimed at decision-makers in the field of logistics and supply chains, outlining the key disciplinary background in a simple and practical way, which is further supported by the main findings of the three researches presented. Furthermore, the monograph is a useful resource for researchers in the field of logistics and supply chains, as it provides insights from multiple perspectives: theoretical, logistics and supply chain practitioners, higher education teachers, colleagues and researchers, and logistics students and graduates. For the latter, the scientific monograph is an excellent additional material for in-depth learning in the field of green and digital transition in logistics and supply chains, as well as an excellent source of new research ideas for creating new knowledge in this research field.

Accordingly, the objectives of the scientific monograph are as follows:

−   review of relevant literature in the field of research;
−   definition of key concepts in the field of sustainable development: sustainability, sustainable development, environmental policy, sustainable production, circular economy, sharing economy, growth and welfare economy;
−   analysis of current trends in the field of sustainable development;
−   analysis of connections between the field of youth and the field of digitalisation;
−   review of key competency models in the field of digitalisation and sustainability;
−   presentation of the field of lifelong learning and its use as a support mechanism in the field of digitalisation and sustainability;

– analysis of the legislative framework in the field of sustainable development, green and digital transition;
– examination of the current level of inclusion of sustainable development and digitalisation topics in higher education programmes in Slovenia, with a special focus on study programmes in the field of logistics and supply chains;
– identification of the knowledge, skills and abilities currently needed in the fields of sustainable development, digitalisation and transversality in the field of logistics and supply chains and assessment of their relevance over a five-year period;
– a comparative analysis of the skills needed for the green and digital transition which have been identified by the business sector, academia and students in the field of logistics and supply chains;
– examination of the characteristics of individuals' sustainable lifestyles and their impact on the individual priorities of the green and digital transition,
– identification of suitable pedagogical approaches for teaching sustainable development and digitalisation topics from the perspective of students of logistics and supply chains;
– and provision of guidelines for further work in the field of green and digital logistics and supply chains to promote a smooth transition to society 5.0.

Following these objectives, the monograph aims to answer the following questions:

– What are the key concepts in sustainable development, and how do these concepts differ from and complement each other?
– How do the fields of sustainable development and digitalisation complement each other?
– To what extent does Slovenia as a country follow the goals of sustainable development?
– For which targets does the Slovenian average deviate positively from the EU average, and for which targets does it deviate negatively?
– What are the most critical sustainable development trends that individuals as part of society are following? Which sustainable development trends are companies following?
– What is the impact of digitalisation and social media on the daily lives of young people?

- What are the key competencies in the field of sustainable development and digitalisation as defined by internationally recognised and national competency models?
- What are the advantages and disadvantages of the most accessible lifelong learning platforms?
- Which economic areas are covered by the current legislation that includes content from the field of sustainable development and how is the EU taxonomy included in the legislation?
- What is the level of inclusion of sustainable development and digitalisation topics in higher education study programmes in Slovenia? Which areas show the highest number of sustainable and digital topics? What are the specificities of study programmes in the field of logistics and supply chains?
- What are the current priority knowledge, skills and abilities in sustainable development, digitalisation and transversality in logistics and supply chains? Over the next five years, which skills will become more important according to the business sector, academia and students?
- Are there any statistically significant differences in the assessments of gaps in knowledge, skills and abilities in the field of sustainable development, digitalisation and transversality between different target groups of participants (the business sector or employees in the field of logistics and supply chains, students of logistics, and higher education teachers, colleagues and researchers in the field of logistics)?
- What are the most appropriate pedagogical approaches for teaching green and digital logistics and supply chain topics according to logistics students?

1.2   Methodology

We use several research methods in the scientific monograph. In the theoretical part, a descriptive approach was used to present the main theoretical starting points and key concepts of our field of research. In the following, the most important theoretical findings were analysed using the synthesis method. Next, the results were combined with the compilation method to present the main findings in a simpler way.

In the research part of the monograph, we used an analytical approach, which was divided into three parts. In the first part, we analysed the sustainability topics included in the current legislative framework in the territory of Slovenia and the tracking of the 17 UN Sustainable Development Goals. In the second part, we analysed the content of higher education study programmes in the Republic of Slovenia based on the occurrence of keywords. The content analysis was extended by using a quantitative approach to data processing. In the third part, we used a quantitative approach based on the questionnaire method. The questionnaire results provided data on the knowledge, skills and abilities needed in sustainable development and digitalisation in logistics and supply chains. The data was analysed with descriptive statistics and non-parametric tests to determine statistically significant differences. For the sake of clarity, the individual methods are presented with the research results.

In the Conclusions chapter, we systematically presented the main findings from both the theoretical and research parts. Furthermore, we provided concrete guidelines for further professional and research work in logistics and supply chains, focusing on the simultaneous green and digital transition of the industry.

2   Review of Current Knowledge

Research, such as the one that collected ancient ice in Antarctica and studied the current composition of the atmosphere, showed an accelerated accumulation of greenhouse gases, especially carbon dioxide. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established to study the impact of these phenomena on the climate. Especially in the last 60 years, human impact on the planet has become unimaginable in scale and speed. According to Rafferty (2023), this period is also known as the *"Great Acceleration"*. It is a post-war period of boom and exponential population growth, massive consumption of fossil fuels and water, food production, global communication, and the use of vast agricultural areas. Carbon dioxide emissions, global warming, ocean acidification, destruction of natural habitats, extinction of species and large-scale exploitation of natural resources also began during this period. These are signs that clearly show that we have significantly changed our planet.

Since the publication of the first IPCC report in 1990, climate change and its socio-economic effects have become one of the main topics for policymakers. The IPCC Glossary (Intergovernmental Panel on Climate Change (IPPC), 2022) provides a general definition of climate change: *"Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) with changes in the mean and/or variability of its properties and lasting for a long period, usually decades or more. Climate change can be the*

result of natural internal processes or external influences, such as modulations of solar cycles, volcanic eruptions and ongoing anthropogenic changes in the composition of the atmosphere or land use." The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change in Article 1 as: *"a change in the climate that is directly or indirectly attributed to human activity, that changes the composition of the global atmosphere and that, in addition to natural climate change, is observed in comparable periods of time."* The UNFCCC thus distinguishes between climate change attributable to human activities that alter the composition of the atmosphere and climate change attributable to natural causes (Intergovernmental Panel on Climate Change (IPPC), 2022).

Climate change and its consequences are highly complex processes that raise several questions. From an ethical perspective, some of the most pressing issues relate to balancing mitigation and adaptation efforts and attributing responsibility for past and present greenhouse gas emissions. The fact that climate change is an intergenerational problem can no longer be ignored. The prosperity and survival of future generations depend more than ever on the decisions we make today. As a result of and with the help of pressures to act from top-down (e.g., through climate policies from international to regional levels) as well as bottom-up (e.g., in the form of simple social initiatives), things are already moving in a positive direction. We are witnessing many solutions that contribute to the transition to a low-carbon society, mitigation of climate change, creation of a fairer society, and provision of a better quality of life.

The exploitation of natural resources has been and continues to be the cornerstone of countries' economies and social systems. Due to the scarcity of resources, the degradation of the environment and the exceptional population growth, this model is no longer sustainable, and a new development paradigm must be found to establish prosperity. Weather extremes and environmental disasters can be perceived as a consequence of economic development, and thus as an environmental protection issue. However, if only an unintended consequence of development in developed countries, this represents a major obstacle for developing countries. In the preface of the report Our Common Future, Brundtland (in World Commission on Environment and Development, 1987, pp. 5-9) excellently highlights that the course of events demonstrates the need to integrate environmental protection with economic policy. He, among others, argues that the warming of the planet or the emergence of degraded environments due to intensive agricultural use should not be addressed only as an environmental protection issue, since the protection of the

environment is directly related to the economic development of countries and social development. We need a new type of economic development that puts social and environmental components on an equal footing with economic ones. We need sustainable development.

Due to the significant changes in the Earth's surface, atmosphere, oceans, and nutrient cycling systems caused by human activities, there are growing calls to name the most recent epoch the Anthropocene. This geological era is defined as an era in which human activities are thought to have driven biophysical changes on a planetary scale. The word itself was coined in 1980 by the American biologist Eugene F. Stoermer. The term became popular at the beginning of the twenty-first century with the help of the Dutch atmospheric scientist and recipient of the 1995 Nobel Prize in Chemistry, Paul Crutzen. The word Anthropocene comes from the ancient Greek ἄνθρωπος (anthropos), meaning man or human, and -cene from *καινός* (kainos), meaning "new". The term is used in a variety of cultural and scientific contexts. While some associate human impact on the planet only with climate change (the warming of the atmosphere, air and oceans due to the use of fossil fuels) the effects of human activity extend far beyond climate change alone. Just think of the accumulation of waste, the construction of cities, roads, etc. The Anthropocene's formalisation depends on whether human impacts on planet Earth will be significant enough to be detectable even in rock layers (Issberner & Léna, 2018).

Today, it is clear that our climate is no longer stable and is warming rapidly. Scientists now agree that human activity is the leading cause of accelerated global warming. Agriculture, urbanisation, deforestation and pollution have caused significant changes to the Earth. By combining all these data, nine Planetary Limits were outlined at the Stockholm Resilience Centre. At the time this monograph was written, four of these limits had already been exceeded: climate change, loss of biotic diversity, species extinction and vegetation cover, and biogeochemical cycles (Issberner & Léna, 2018). The research and findings of both Planetary Limits and IPCC reports have been used to formulate various climate policies and international negotiations. Among the more important international environmental and climate agreements are certainly the Paris Agreement (entered into force in 2016) and the Kyoto Protocol (in force from 2005 to 2012 and extended for the period 2013-2020), which were adopted within the framework of the United Nations Framework Convention on Climate change (UNFCCC, 2019, 2023).

The exploitation of natural resources and the processing of materials, fuel and food strongly impact the generation of greenhouse gases and the loss of biodiversity (Evropska komisija, 2019). As many as 15 tons of raw materials are consumed per capita in the EU, and the needs for food, energy and water are only increasing. World Ecological Debt Day marks the day when we consume all the raw materials the planet can produce in a year. In 2023, the World Ecological Debt Day was August 2, 2023. For Slovenia, the World Ecological Debt Day was already April 18 ('About Earth Overshoot Day', n.d.). The environment is no longer meeting our needs. The United Nations (hereinafter: UN) report states that by 2030, food needs will grow by 50% in twenty years, energy needs by 40%, and drinking water needs by 30% (United Nations Secretary - General's High-level Panel on Global Sustainability, 2012, p. 11).

On average, an EU citizen generates 4.5 tons of waste, only half of which ends up in landfills (Ministrstvo za okolje, podnebje in energijo, 2023). In Slovenia, the amount of municipal waste is increasing year by year. In 2021, 518 kg of municipal waste was generated per inhabitant, which is 53 kg of waste per inhabitant more than in 2016. The recycling rate of municipal waste is increasing and approaching 60%. The current linear model of the economy based on the continuous use of natural resources is not sustainable, which is why a transition to a circular economy is necessary. At present, the share of material used in circulation stands at only around 10% (Laznik & Žitnik, 2023).

Environmental pollution with greenhouse gases affects climate change, which manifests locally and globally in extreme weather events (IPCC, 2023, pp. 4-5). The European Energy Agency (hereinafter: EEA) lists the following as the primary sources of pollution: energy use in buildings, the industrial sector, agriculture and road transport (European Environment Agency, 2023a). To measure the negative consequences of climate change, the EEA uses an indicator that shows the economic damage caused by climate change in EU countries. Considering the criterion of population size, the most significant damage between 1980 and 2022 was caused in Slovenia, namely EUR 3,452 per inhabitant. Only 4% of all claims were insured (European Environment Agency, 2023b; *Geografski Atlas Naravnih Nesreč v Sloveniji (GANNS)*, n.d.). Regarding air quality in Slovenia, exceedances of the limit values for fine particles are recorded in urban areas, especially during the heating season (Bec et al., 2022, p. 75 and pp. 119-120). Air pollution affects our ecosystem by

causing damage to forest areas and agricultural land, and it is also reflected in the loss of biodiversity.

Awareness of environmental challenges and the climate crisis requires action, even at the micro level of each individual. However, if we want each individual to contribute to mitigating and adapting to climate change, we first need to ensure that we are better informed about the current challenges and establish the concept of new knowledge acquisition. The theoretical part of the monograph defines the most important concepts related to the field of sustainability and covers several sub-chapters. The first subchapter defines key terms relating to sustainability, durability, and sustainable development, whereby the focus is on sustainable development goals and ways to achieve them. The subsection also defines the taxonomy of sustainable development and the key orientations of environmental policy. The remaining part of the subchapter, focuses on sustainable production and consumption, emphasising the explanation of current concepts that are meaningfully related to sustainability: sharing economy, degrowth and the economy of wellbeing. The following subsections are devoted to trends in the field of sustainability as well as trends in the field of digitalisation. The subchapters offer a brief overview of the most current content in the field, together with statistical data relating to aspects of sustainable consumption and the use of digital tools among young people. The third focus of the theoretical part of the monograph is competency models in sustainable development and digitalisation. Various competencies necessary for a smooth transition to Society 5.0 are presented. In addition to introducing key competency models for sustainability and digitalisation, the chapter concludes with examples of good practices in lifelong learning in sustainable development and digitalisation. These provide an effective solution for the rapid acquisition of the mentioned competencies. In the chapter, we learn and define basic concepts such as sustainability, sustainable development, environmental policy, sustainable production, sharing economy, degrowth and welfare economy.

2.1   Sustainable, Sustainability and Sustainable Development

The dictionary of the Slovenian literary language defines sustainability as "*a characteristic of something in terms of how long it can exist, is useful*" ('Trajnost', 2022). To ensure long-term usefulness, it is essential to act responsibly. Although sustainability has been a part of human life for a long time, the definition of this concept is relatively young and dates back to the 20th century. Sustainable development was

defined in 1987 by the Brundtland Commission as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 1987). The reason for this is new knowledge resulting from exponential population growth, overexploitation of the planet, resource depletion and subsequent environmental pollution, mainly due to the massive use of non-renewable natural resources. The starting point for defining the concept of sustainability is Malthusianism, developed by the British economist and demographer Thomas Robert Malthus in his 1798 work "An Essay on the Principle of Population". The main idea of Malthusianism is that the population grows exponentially. In contrast, the resources for subsistence grow linearly, which means that at some point, there will be a surplus of population that will exceed the available resources. The result will be poverty, famine and natural disasters (Ashraf & Galor, 2008), which we have been witnessing for some time.

Based on the fact that natural resources are limited, several definitions describe sustainability as "the characteristic of a process or state that is maintained indefinitely" (Anko, 1992) and as "a way of using natural systems that does not change the essential properties of the system in the long term and does not reduce its capacity for natural renewal" (Anko et al., 2009). When understanding the concept of sustainability, it is essential to highlight the following facts (Blackburn, 2007; Ukaga et al., 2010):

−   sustainability represents a high and often unattainable goal, but at the same time, it is the only signpost to the future;
−   sustainability is a changed way of looking at the world and our place in it;
−   sustainability is reflected not only in big decisions but also in the individual's small, everyday decisions and in the constant search for answers to the questions "Am I allowed to do what I can?" and "Do I really need what I want?";
−   sustainability represents a systemic approach and understanding of the cause-effect relationship;
−   and sustainability is dynamic, as it depends on the interplay of natural, social and economic circumstances that are constantly changing.

An important part of the concept of sustainability is the so-called wellbeing, which can be understood as a positive evaluation of an individual's life, including positive emotions, work, life satisfaction and meaning. From this, we conclude that life

satisfaction is one of the elements of an individual's wellbeing or subjective wellbeing (Kjell, 2011). With the growth of prosperity in society, differences in wellbeing are no longer exclusively related to income. Interpersonal relationships, job satisfaction and numerous non-economic indicators of wellbeing are becoming more important, such as social capital, democratic leadership, human rights, inclusion and connectedness, solidarity between generations and vulnerable groups, tolerance, creativity and group wisdom, interpersonal ties and joy. Subsequent benefits for the wider society include but are not limited to local jobs, reduced import dependence, increased competitiveness of the economy, reduced pressure on health and wellbeing and resilience to external shocks (Helne & Hirvilammi, 2015). There are four key areas in which sustainable community management of living resources can create wellbeing for the individual, the community and the planet: spatial planning, food self-sufficiency, energy efficiency and energy supply from local renewable sources, and a local circular economy with sustainable consumption (Karba et al., 2016).

The concept of sustainability is often equated with the concepts of ecological and green. Although they are similar there are differences. The concepts of "ecological" and "green" are largely synonymous, referring to the environmental component of sustainability. "Green" combines elements of environmental care, while "ecological" refers to the impact of living organisms on the environment. In both cases, it refers to behaviour that is primarily focused on preserving nature and the environment, or in other words, it reflects an exclusive focus on the environmental dimension of sustainability. The concept of "sustainability", "durability" or "sustainable development" is broader and, in addition to "ecological" or "green", also includes social and economic dimensions that are closely related to the definition of "sustainable development".

The most commonly used definition of sustainable development is that of the World Commission on Environment and Development (WCED, 1987), which defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development has three pillars: environmental, social and economic (Figure 2).
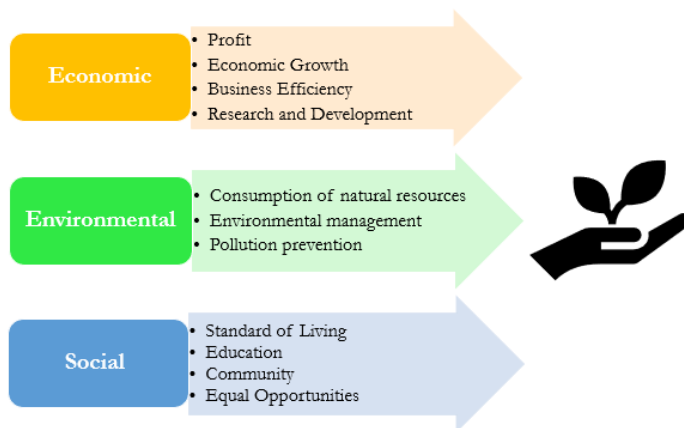
Figure 2: Pillars of sustainable development
Source: Own work.

Recently, we have been witnessing global climate change. To ensure our survival, we must learn to coexist sustainably on this planet. We need to change the way we think and act – as individuals and as a society. At the same time, education must also change, namely towards the development of a peaceful and sustainable world that ensures the survival and wellbeing of current and future generations. Therefore, it is necessary to develop new competencies and face the numerous challenges of modern times (Karba et al., 2016). The greatest challenge in development planning is to transform all three pillars of sustainability or factors of the so-called comprehensive wellbeing into strategies and activities that contribute to their simultaneous achievement. To facilitate monitoring and guide sustainable action, the UN has developed 17 sustainable development goals, which the global economy should strive to achieve by 2030.

2.1.1 Sustainable Development Goals

The 2030 Agenda for Sustainable Development was adopted at the United Nations Summit 2015 (*Spremenimo Svet: Agenda Za Trajnostni Razvoj Do Leta 2030*, 2015). The agenda consists of 17 goals for monitoring sustainable development by 2030, the progress of which is monitored at the operational level through a set of indicators prepared by Eurostat and updated once annually (*Kazalniki Ciljev Trajnostnega Razvoja*, n.d.). The Sustainable Development Goals, grouped by pillar, are presented in Table 1.

Table 1: Sustainable Development Goals by Pillar

Pillar of sustainability	Sustainable Development Goals
Economic	Decent Work and Economic Growth (SDG 8) Industry, Innovation and Infrastructure (SDG 9) Reduced Inequality (SDG 10) Responsible Consumption and Production (SDG 12)
Environmental	Clean Water and Sanitation (SDG 6) Climate Action (SDG 13) Life Below Water (SDG 14) Life on Land (SDG 15)
Social	End Poverty (SDG 1) End Hunger (SDG 2) Health and Wellbeing (SDG 3) Quality Education (SDG 4) Gender Equality (SDG 5) Affordable and Clean Energy (SDG 7) Sustainable Cities and Communities (SDG 11) Peace, Justice and Strong Institutions (SDG 16)
Partnerships for the Goals (SDG 17) is a goal that encompasses all three pillars and has a unifying role.	

Source: (United Nations, n.d.)

The EU has made significant progress in the last five years[1] on SDG 8, SDG 1 and SDG 5, moderate progress on SDG 10, SDG 4, SDG 16, SDG 3, SDG 9, SDG 14, SDG 11, SDG 12, SDG 6, SDG 7 and SDG 2, and is moving away from the set targets for SDG 13, SDG 15 and SDG 17 (Figure 3) (Ekkehard et al., 2023).
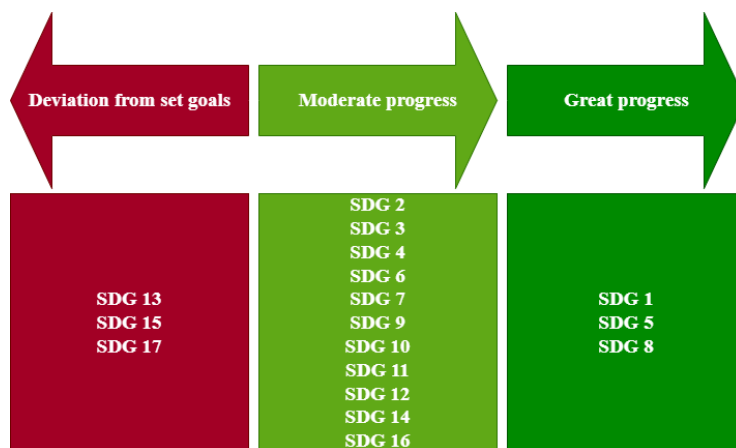
Figure 3: EU progress towards achieving SDG indicators
Source: (Ekkehard et al., 2023)

---

[1] The last five-year period covers either the period between 2016-2021 or the period between 2017-2022.

The status of achieving the SDG targets in Slovenia is shown in Figure 4. It is schematically divided into four quadrants. The first quadrant shows the areas or indicators in which the country is making progress or is approaching the set goals, with the current state of the area or indicator being better than the EU average. The second quadrant shows the areas or indicators where the country is making progress or is approaching the set goals. However, the area's current state or indicator is worse than the EU average. The third quadrant shows the areas or indicators in which the country is falling behind in achieving the set goals, with the current state of the area or indicator still being better than the EU average. The last, fourth quadrant shows the areas or indicators in which the country is falling behind in achieving the set goals, and the current state of the area or indicator is, on average, worse than the EU average (Ekkehard et al., 2023).

Based on the report published in May 2023, Slovenia is progressing towards the set Sustainable Development Goals. When we examine the achievement of the goals, Slovenia is below the EU average in six areas, namely in the areas of SDG 2, SDG 12, SDG 13, SDG 9, SDG 16 and SDG 3. However, it is progressing in the desired direction of achieving the final targets for these indicators. Slovenia is above the EU average in the areas of SDG 11, SDG 5, SDG 7, SDG 8, SDG 17, SDG 15, SDG 4, SDG 1, SDG 6 and SDG 10 indicators and approaching the set goals (Ekkehard et al., 2023).
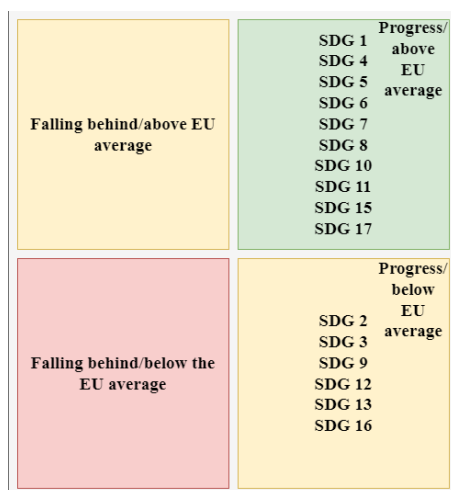
Figure 4: Status of achieving SDG goals in Slovenia
Source: (Ekkehard et al., 2023)

The presented indicators can influence the motivation to upgrade individuals' and organisations' sustainability and digital competencies. We will present the indicators whose progress is being monitored for Slovenia:

−   **Indicator SDG 1** – is about eliminating poverty within the EU. During the observed period, the proportion of people exposed to poverty and social exclusion decreased in the EU, but unfortunately, by less than planned. Individuals with a low level of education are more exposed to poverty. Education and training can help individuals escape the vicious circle of poverty in which they are trapped. The proportion of these individuals in Slovenia is lower than the EU average, but there is still room for education and training for individuals with a low level of education (Ekkehard et al., 2023).

−   **Indicator SDG 2** – covers eliminating hunger in the EU or the food problem. The share of people who are overweight is concerning as in 2019, it reached 16.5% at the EU level. In Slovenia, this share is above the EU average, reaching around 20% in 2019. Education and training in the field of sustainable development can contribute to changes in eating habits, which can affect the reduction of the share of people who are overweight. There has been a noticeable increase in the share of sustainable agricultural production, which in 2020 was 9.1% at the EU level, showing a 2.5% increase over the five-year observation period. In Slovenia, the share of land intended for sustainable production is higher than the EU average, which is encouraging. In 2021, 25% more financial resources were allocated to research and development in agriculture than in 2016. The negative impacts of agricultural production on the environment are not decreasing or are decreasing less than predicted. In Slovenia, the amount of ammonia emissions is significantly higher on average than in the EU (Ekkehard et al., 2023). Education and training in sustainable development can help spread sustainable farming in Slovenia and reduce the negative impacts of agricultural production on the environment.

−   **Indicator SDG 3** – covers health and wellbeing. Life expectancy in Slovenia is slightly higher than the EU average of 64 years. The health status of the population of Slovenia does not deviate from the health status of the average EU citizen. In 2021, 69% of the EU population assessed their health status as good or very good. The number of deaths due to work-related accidents is decreasing. The number of deaths from traffic accidents is also decreasing, but unfortunately by less than predicted. The decrease in the number of traffic

deaths between 2016 and 2021 is 16.3%. The number of premature deaths due to exposure to particulate matter is also not decreasing as predicted. Between 2005 and 2020, premature deaths decreased by 44.8%, but the target was 55% (Ekkehard et al., 2023). Education and training in sustainable development can help improve the population's health and improve the wellbeing of individuals at work and in their free time. The NOO workshop "Traveling with a Green Suitcase", introduces participants to sustainable ways of travelling, from creating a sustainable travel plan to evaluating the positive effects of such a trip (Pavić & Cvahte Ojsteršek, 2023). The NOO workshop "Designing Hybrid Human-machine Workplaces through the Perspective of Leanness and Ergonomics" introduces participants to the development of hybrid workplaces during the transition to Industry 5.0 (Gajšek & Šinko, 2023).

– **Indicator SDG 4** – is related to education. The EU's goal is that by 2030, at least 80% of EU citizens aged between 16 and 74 should have at least basic digital competencies. This presents an opportunity to provide education within the framework of the NOO project in the area of digital competencies. In 2021, the share of people with essential digital competencies was 53.9%, which means the EU is still quite far from the target. There are also differences between the age groups. While 71.2% of people aged between 16 and 24 had at least essential competencies in the field of digital technology, in the age group between 25 and 54, this share was 62.1% and in the age group between 55 and 74, only 34.6% (considering the data for 2021). Education within the framework of the NOO project can be aimed at several age groups, as digital competencies will soon be necessary to carry out everyday tasks and work duties. The level of digital competencies is also linked to the level of education. While in 2021, 79% of people with tertiary education had at least essential digital competencies, only 31.9% of people with low or no education had at least essential digital competencies. Unfortunately, Slovenia does not meet the EU average, which is why training within the framework of the NOO project, aimed at employed individuals, can contribute to raising the level of digital competencies in society. The share of people with tertiary education in Slovenia is increasing, which places Slovenia above the EU average. It is necessary to offer educational programmes in tertiary education where young people will acquire sustainable and digital competencies. In adult education, it is encouraging that in 2022, the share of adults participating in adult education in Slovenia increased compared to 2017. Slovenia is above the EU average in this area. This means individuals

are interested in participating in education and training to acquire digital and sustainable competencies (Ekkehard et al., 2023). The NOO workshop "Business Information Systems" introduces users to comprehensive management systems that enable the management of business processes and presents them with the importance of the connection between material and information flow (Rupnik, 2023b). The NOO workshop "Decision Support with Simulations" introduces participants to the planning and analysis of logistics processes with simulation techniques, namely how to create a simulation model and analyse the simulation results (Rupnik, 2023a). The NOO workshop "Basics of Data-Based Business Decision-Making" introduces participants to collecting data, performing simple analyses and preparing measures based on the analyses performed (Pavić, 2023). The NOO workshop "Information and Computer Literacy" introduces participants to the Windows environment used by organisations to carry out their activities (Marcen, 2023). The NOO Workshop "Information and Computer Security" introduces participants to the safe use of websites through the understanding of the possibilities of hacking and the consequences such hacking has on the operations of an organisation (Kajba, 2023).

– **Indicator SDG 5** – relates to gender equality. In this area, the most significant improvements are in the area of representation of women in management positions. The gap in the area of wage policy is also decreasing. The gender pay gap in Slovenia is among the lowest in the EU. However, the problem remains because the gender employment gap at the EU level is not closing as in Slovenia. Between 2002 and 2022, the share of women with tertiary education increased from 25.3% to 47.6%, while the share of men increased from 21% to 36.5% (Ekkehard et al., 2023). Education and training within the framework of the NOO project are aimed at equal gender representation to create a sustainable and resilient society.

– **Indicator SDG 6** – This goal should be highlighted due to its relevance to the EU's focus on preserving water resources. At the EU level, water supply and wastewater management are improving. However, water quality is deteriorating. An increased presence of nitrates and phosphates in water has been observed. Water quality in Slovenia is better than the EU average. Sustainable water management is rare. The problem is that water quality is not improving as quickly as expected. Training within the NOO project framework on sustainable

development through sustainable exploitation or use of water resources can help improve water quality (Ekkehard et al., 2023).

− **Indicator SDG 7** – is related to energy. The EU is not achieving its goals in the field of energy consumption and reduction of energy use. The share of renewable sources in final energy consumption is also below the set target. In 2021, this share at the EU level was 21.8%. The share of renewable energy sources in Slovenia is above the EU average, but this is only a small consolation. The EU remains heavily dependent on energy imports. It is encouraging that Slovenia is below the EU average in this area despite its high dependence on energy imports. Individuals and organisations can be introduced to renewable energy sources and their importance for achieving the set goals in energy consumption and integrating renewable energy sources into the energy system during training courses within the NOO project for improving sustainable competencies (Ekkehard et al., 2023). The NOO workshop "Energy Self-sufficiency for Individuals and Small Businesses" introduces participants to the concept of the energy cycle. It shows them how to determine the required power of a power plant and heat pump and calculate the return on investment (Obrecht, 2023b).

− **Indicator SDG 8** – is related to the labour market, which is a key area for us. We educate individuals who are entering the labour market or upgrading the knowledge they need to be more competitive in the labour market. The share of young people who are unemployed and not involved in any education is decreasing. However, in 2022, as many as 11.7% of young people aged between 15 and 29 in the EU were either unemployed or not involved in any educational process. In Slovenia, this share is even lower. Regardless of this, there is always an opportunity for education within the framework of the NOO project in sustainable and digital competencies. These skills will be highly sought after in the labour market in the future, so we offer young people the opportunity to upgrade their knowledge through education within the NOO project or by enrolling in study programmes that include these two areas in the curricula. The acquired sustainable and digital competencies will represent a competitive advantage for these individuals in the labour market. This will improve their employment opportunities, and companies will acquire the personnel they need or will need when transitioning to a sustainable way of doing business. Unemployment is decreasing; employment is increasing. In 2022, the share of employed people in the EU aged between 20 and 64 was 74.6%. In Slovenia,

this share is even higher. The human resource pool is exhausted. In 2022, only 2.4% of the potential workforce were long-term unemployed. In Slovenia, this share is even lower. Therefore, individuals with interdisciplinary skills in digitalisation and sustainable development are and will be highly sought-after personnel. The EU records stable economic growth while simultaneously reducing the carbon footprint of products. This decreased in 2020 as a result of the pandemic. The share of investments in gross domestic product (hereinafter: GDP) in Slovenia is below the EU average, but between 2016 and 2021 the share increased to 20%. Knowledge in sustainable development can also contribute to reducing the carbon footprint of products, namely the knowledge on how to design sustainable products on the one hand and how to recognise sustainable products in the environment on the other (Ekkehard et al., 2023). This knowledge is provided by education and training within the NOO project. The NOO workshop "Logistics and Supply Chains" presents the importance of logistics for a successful and efficient organisation through a game. Participants learn how logistics adds value to products and services, thus creating a competitive advantage for companies (Kramar, 2023a). The NOO workshop "Basic Business Decision-making based on Data" introduces participants to the method of collecting data, performing simple analyses and preparing measures based on the analyses performed (Pavić, 2023).

–   **Indicator SDG 9** – is related to innovation and the economy. Investment in research and development in sustainable development is increasing, but unfortunately by less than expected. In 2021, an average of 2.26% of GDP was allocated to research and development in the EU. Most of the funds are provided by the economy. New projects that will include the field of sustainable development will be needed. The NOO mechanism is dedicated to developing educational content to spread digital and sustainable competencies. The number of researchers is increasing, which means that researchers in sustainable development will be desirable and sought-after staff in the labour market. Training within the framework of the NOO project in sustainable development can inspire individuals to pursue research and introduce them to this field. Companies can use these workshops to train their staff or recruit new staff as needed. The share of people with tertiary education is growing faster than expected, which means there is a desire to obtain this level of education. At the EU level, 42% of the population aged between 25 and 34 had a tertiary education in 2022. Offering opportunities to develop sustainable and digital competencies

can inspire young people to study this field. Slovenia invests less in research and development than the EU average. However, it is encouraging that the share of researchers in the total workforce in Slovenia is higher than the EU average, which in 2021 was 1.5%. Regarding the number of patents filed, Slovenia lags far behind the EU average. The goals in the field of sustainable production at the EU level align with the set targets. Industrial emissions are decreasing. Unfortunately, Slovenia is still below the EU average here. Individuals and organisations can, through the sustainable and digital competencies they acquire as part of the NOO project training, transform business processes to reduce the negative impacts of a company's operations on the surrounding area through the development and implementation of patents in the company's business processes. The goals for sustainable transport at the EU level have not been achieved. The share of passenger transport by bus and train has fallen sharply, which can be attributed to measures to contain the pandemic. Compared to 2019, the share in 2020 decreased by 4.7% to 12.8%. This share also fell sharply in Slovenia. Slovenia is among the countries with the lowest level of passenger transport by bus or train. The share of freight transport by rail and inland waterways at the EU level has also fallen. Compared to 2012, when this share was 26.5%, it fell to 22.7% in 2021. In Slovenia, the share in 2021 remained at a similar level as in 2016 and is higher than the EU average. The mere fact that individuals have sustainable and digital competencies will not redirect these trends towards the set goals. Notwithstanding, knowledge of sustainable means of transport is still a competence that training within the framework of the NOO project can offer to individuals and organisations. It is encouraging that as many as 70.2% of households in the EU have access to broadband Internet, which, among other things, enables the implementation of the educational process both in person and remotely. A prerequisite for the successful development of sustainable and digital competencies within the framework of the NOO project training is broadband Internet, as it enables the flow of information between workshop providers and training participants (Ekkehard et al., 2023). The NOO workshop "How to Reduce Your Environmental Footprint" presents participants with an individual or organisation's carbon and ecological footprint as methods or tools for environmental assessment (Obrecht & Denac, 2023). NOO workshop "Environmental Assessment: LCA (Life Cycle Assessment)" introduces participants to the usefulness of the LCA method for assessing the environmental life cycle of products and using LCA analysis for environmental policy planning (Denac, 2023).

- **Indicator SDG 10** – covers the area of reducing inequality. Inequalities within countries have decreased slightly. However, the gap between the incomes of the poor and the rich remains too wide. The carbon footprint of individuals is also linked to inequality, as the poorer class contributes fewer greenhouse gases through its activities than the richer class. In 2020, the richer class produced five times more greenhouse gases per capita than the poorer class. Economic inequality can also affect opportunities to develop individuals' knowledge and competencies. The risk of poverty in Slovenia is lower than the EU average. Purchasing power in Slovenia is slightly below the EU average. Inequalities between EU member states are also decreasing, but differences between the North and South on the one hand and the West and East of the EU on the other remain. Migration policy requires further action to improve the situation (Ekkehard et al., 2023). Education and training in the field of sustainable development must be focused on finding solutions to reduce inequalities in the European society of the future.

- **Indicator SDG 11** – refers to the sustainable management of urban areas. The quality of life in urban centres has improved. The number of deaths associated with exposure to particulate matter has decreased significantly. In Slovenia, the number of premature deaths associated with exposure to particulate matter is below the EU average. In the area of sustainable mobility, we can once again single out the decline in the use of public transport in 2020. It is, however, encouraging that there is a downward trend in road fatalities between 2016 and 2021. Unfortunately, the number of fatalities in Slovenia is still higher than the EU average. Through education and training within the NOO project, individuals can learn about the digital environment and sustainable development, which will be useful for creating safe and sustainable urban areas. The waste recycling field is improving but has not reached the set goals. In 2021, 49.6% of collected waste was recycled at the EU level. It is encouraging that Slovenia ranks among the countries with the highest level of household waste recycling in 2021, but further efforts will be needed to achieve the goals set at the EU level. Training within the framework of the NOO project can, through the provision of sustainable content, improve the awareness of individuals and organisations about the importance of environmental management and offer options for managing waste recycling sustainably (Ekkehard et al., 2023). The NOO workshop "Phases of Sustainable Operation of an Organisation" introduces participants to the sustainable operation of an organisation and the

importance of a green team for achieving sustainable operation (Knez, 2023). The NOO workshop "Digitalisation of Business – Planning" introduces participants to the theoretical foundations and guidelines for managing e-business, information and cybersecurity, and managing IT risks and investments (Jereb, 2023b). The NOO workshop "Digitalisation of Business – Implementation" introduces participants to the importance of software quality assessment and the importance of software life cycle management (Jereb, 2023a). The NOO workshop "Urban Logistics - a Complex but Manageable System" introduces participants to the concept of urban logistics and the importance of proper urban logistics management for optimal distribution operations (Cvahte Ojsteršek & Topolšek, 2023b).

- **Indicator SDG 12** – is related to responsible consumption and production. At the EU level, waste accumulation has decreased, but unfortunately, the share of renewable materials used is not increasing as forecasted. On average, Slovenia is at the EU level in the use of renewable materials, but we produce less waste than the EU average. In 2020, the average EU resident created 4,813 kg of waste. At the EU level, the environmental footprint of products is decreasing, but unfortunately, the use of hazardous substances is increasing. Energy productivity in the EU is increasing. The EU (and Slovenia) heavily depends on raw material imports. The EU has the highest level of self-sufficiency in copper, which is 62.3%. Other raw materials achieve lower levels of self-sufficiency, or the EU depends exclusively on imports. The green economy is gaining importance as the added value of green economy products and services is increasing. Greenhouse gas emissions from new vehicles are decreasing. In 2021, this value was 116.3 g/km at the EU level. Unfortunately, the average emissions of new vehicles in Slovenia are higher than the EU average. The share of zero-emission vehicles in Slovenia is much lower than in the EU (Ekkehard et al., 2023). Education and training in sustainable development can contribute to more responsible consumption and sustainable design and production of products. The NOO workshop "Towards an Environmentally Sustainable Product with Ecodesign" introduces participants to ecodesign as a tool for environmentally friendly product design (Obrecht & Knez, 2023). The NOO workshop "How to Distribute Products? - An Optimal and Sustainable Distribution Strategy" introduces participants to distribution as part of a company's business processes and how to choose the optimal distribution

strategy based on the given decision-making parameters (Cvahte Ojsteršek & Topolšek, 2023a).

– **Indicator SDG 13** – is related to climate action. The EU is not meeting its goals in reducing greenhouse gas emissions. Between 2016 and 2021, the EU's share of greenhouse gas emissions fell by 8.9%. The use of renewable energy sources is increasing, but at a slower rate than expected. At the EU level, 21.8% of energy was obtained from renewable sources in 2021. Environmental damage due to climate change at the EU level amounted to more than 500 billion euros between 1980 and 2021. Slovenia incurs significant costs in this area, as it was the second most exposed country in the EU in 2016. Education and training within the framework of the NOO project can help to understand the importance of measures to reduce greenhouse gas emissions, the consequences of global warming and the importance of using renewable energy sources (Ekkehard et al., 2023). NOO workshop "Environmental Assessment LCA" presents the usefulness of the LCA method for assessing the environmental life cycle of products and using LCA analysis for planning environmental policy (Denac, 2023). NOO workshop "Towards an Environmentally Sustainable Product with Ecodesign" presents ecodesign as a tool for environmentally friendly product design (Obrecht & Knez, 2023). NOO workshop "5 Steps for Designing a Supply Chain" presents the interconnectedness of supply chain members for the purpose of designing a supply chain in 5 steps (Obrecht, 2023a). NOO workshop "The Impact of the Purchasing Function on Greater Resilience" presents to participants the importance of purchasing for a company's operations, namely how to design purchasing strategies to achieve greater organisational resilience (Kramar, 2023b).

– **Indicator SDG 14** – relates to life below water. Unfortunately, the state of marine waters is deteriorating. Rising water acidity presents a major problem. In 2021, the pH value of the oceans fell to 8.049. The share of coastal areas suitable for swimming is increasing slightly. The share of protected marine areas is increasing as forecasted, which can help preserve the marine ecosystem. For Slovenia, this share is lower than the EU average. Progress has also been achieved in the sustainable management of fish stocks (Ekkehard et al., 2023). Education and training in the field of sustainable development can help raise awareness about the preservation of marine ecosystems.

– **Indicator SDG 15** – relates to life on land. The share of forested areas is increasing. In 2018, 43.5% of the EU's surface area was forest. Slovenia is one

of the most forested countries in the EU. Slovenia's share of protected areas is also higher than the EU average. In 2021, the EU average was 26%, while the share of protected areas in Slovenia was 40.5%. Ecosystem pollution is decreasing. The state of the river system in the EU has been improving since 2000. However, the possibility of environmental degradation is increasing. Unfortunately, we also find that biodiversity is decreasing. In the EU, the population of bird species fell by 6.8% between 2006 and 2021 while the butterfly population fell by 24.3% between 2005 and 2020 (Ekkehard et al., 2023). Education and training in sustainable development can help raise awareness about preserving terrestrial ecosystems. The NOO workshop "Climate Mural" raises awareness of climate change through a mural drawn based on maps of the causes and consequences of global warming (Vrčon, 2023).

− **Indicator SDG 16** – covers the areas of peace, justice and strong institutions. Trust in EU institutions and the judicial systems of individual Member States is decreasing. In 2023, only 49% of EU citizens trusted the European Parliament. The situation in the area of corruption perception is not improving. In terms of corruption perception, Slovenia is at a similar level to the EU. In Slovenia, trust in EU institutions is lower than the EU average. Security in Member States has improved (Ekkehard et al., 2023). Education and training in sustainable development must guide individuals and organisations towards a commitment to peace and justice, for which we will need strong institutions in the future society.

− **Indicator SDG 17** – relates to the area of cooperation between countries. In the area of partnerships for achieving goals, the EU is not reaching its targets. Financial assistance to developing countries is less than planned, while imports from these countries are increasing. In 2022, the value of imports amounted to 1,508 billion euros. Training courses within the framework of the NOO project can offer individuals knowledge about sustainable supply chains, namely that finding the cheapest supplier on the other side of the world may be economically justified but not sustainable. The growing debts of individual countries also pose a problem. Unfortunately, Slovenia is already above the reference limit for borrowing but still below the EU average. The share of environmental taxes in the tax treasury has also decreased. In 2021, it was only 5.5% at the EU level. Training within the NOO project can provide individuals with knowledge through digital and sustainability competencies that they will use in planning

sustainable financial statements at the local, regional, national or international levels (Ekkehard et al., 2023). The NOO workshop "How to Exploit Disruptions to Create Resilient Supply Chains" will introduce participants to supply chain disruptions in recent years that have influenced the preparation of measures to adapt the operation of supply chains (Obrecht, 2023c).

In the past, restrictions, promotions and guidelines for sustainable operations were primarily the responsibility of states (e.g., the Kyoto Protocol), large companies and organisations that were the most polluting (e.g., the IPPC Directive), and financial institutions that finance both unsustainable and sustainable projects were excluded from the system. In order to target financing and subsidise sustainable investments, the EU has also developed a system for encouraging sustainable investments, which also includes banks, funds and other financial institutions, which means that in the future, the flow of money will be significantly more directed towards sustainable investments, which will also enable more active pursuit of the 17 Sustainable Development Goals.

2.1.2 Taxonomy for Promoting Sustainable Investments

To facilitate the transition to climate neutrality, the EU has adopted the so-called EU Taxonomy (Taxonomy for Promoting Sustainable Investment) to provide a simple way to demonstrate a company's sustainable performance. The ultimate goal of the EU Taxonomy is to achieve sustainable business performance, and it will be important for companies to integrate sustainability as a component of risk management and to promote investments focused on sustainable development (*EU Taxonomy Overview*, n.d.). The six objectives of the Sustainable Development Taxonomy are: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and conservation of biodiversity and ecosystems (Figure 5) (*EU Taxonomy Overview*, n.d.).
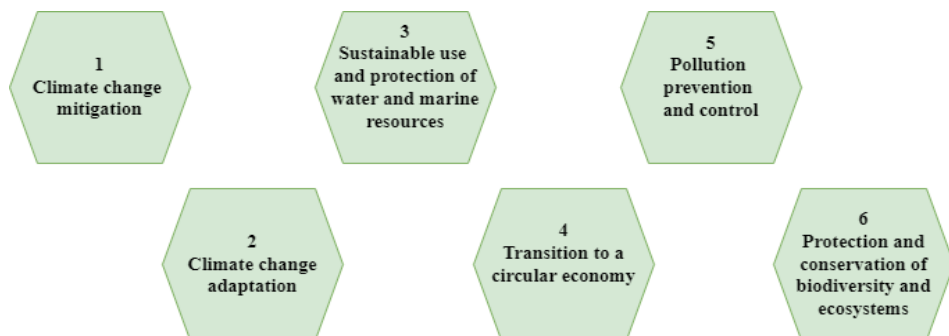
Figure 5: EU Sustainable Investment Taxonomy
Source: Own work.

Climate change mitigation as a climate act makes an essential contribution of economic activity to achieving environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

− using renewable energy sources for its operations;
− implementing processes according to the principle of energy efficiency;
− using climate-neutral mobility;
− using renewable materials of sustainable origin;
− using carbon capture and storage technologies to achieve a net reduction in greenhouse gas emissions;
− enhancing soil carbon sinks and sustainably managing the landscape;
− and establishing and using energy infrastructure that enables decarbonisation of energy systems and produces sustainable fuels.

Climate change adaptation as a climate act makes an essential contribution of economic activity to achieving environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

− incorporation of tailor-made solutions into business operations that contribute to reducing the risky impact of current and future business operations on the

environment and its stakeholders without increasing the risk of adverse impacts on the environment of the business;

- introduction of smarter adaptation, which includes building on existing knowledge and managing uncertainty;
- introduction of a systems approach to support policy development at all levels and in all sectors;
- promotion of faster adaptation, which includes accelerating adaptation in all areas;
- and strengthening of international action for climate resilience.

The sustainable use and protection of water and marine resources as an environmental act makes an essential contribution of economic activity to the achievement of environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

- the company's activity affecting the maintenance of sustainable use and protection of water and marine resources or preventing the deterioration of water and marine resources that are in their natural state;
- the company ensuring appropriate collection, treatment and discharge of wastewater and thus preventing environmental pollution by microplastics, pharmaceuticals or other waste;
- not endangering drinking water sources;
- improving accessibility to drinking water;
- managing water and marine resources efficiently and sustainably;
- contributing to mitigating the consequences of weather extremes that affect the state of water and marine resources;
- and ensuring the sustainable use of marine water services.

The transition to a circular economy as an environmental act makes an essential contribution of economic activity to achieving environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

- contributing to the transition to a circular economy, primarily through waste prevention, reuse and recycling;
- using natural resources efficiently by reducing the use of primary raw materials while simultaneously increasing the use of secondary raw materials and by-products;
- increasing the useful life of products, upgradeability, repairability (spare parts should be available for at least 4 years from the date of purchase of a new product), sustainability or reuse of products;
- increasing the recyclability of products by reducing the amount of non-recyclable raw materials and replacing them with recyclable materials;
- reducing the content of hazardous substances in products by providing sustainable alternatives and improving the traceability of hazardous substances;
- increasing the quality of secondary raw materials that can be used in company processes;
- preventing and reducing the amount of waste and garbage generated in the performance of economic activities through high-quality waste recycling;
- developing solutions for the development of waste management infrastructure;
- organising recycling in a way that increases the quality of recycled waste;
- enabling remanufacturing;
- limiting single use;
- introducing a ban on the destruction of unsold non-perishable goods;
- and exploiting the potential of digitalisation.

Pollution prevention and control as an environmental act makes an essential contribution of economic activity to the achievement of environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

- contributing to the prevention of pollution;
- improving the quality of life in the vicinity of companies or areas where economic activity is carried out;
- reducing harmful effects on human health and habitat;
- improving control over chemicals;

–   and ensuring waste management (decomposition of products to reuse individual components).

The protection and conservation of biodiversity and ecosystems as an environmental act   makes an essential contribution of economic activity to the achievement of environmental objectives through (Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za EGP), 2020):

–   achieving a favourable conservation status for natural species and preventing their deterioration;
–   protecting and restoring ecosystems to improve their condition;
–   remediating contaminated areas and preventing soil degradation through the use of sustainable agricultural practices;
–   and sustainably managing ecosystems.

The purpose of the taxonomy is to classify economic activities based on their impact on the environment, namely whether they are sustainable economic activities or not. The following criteria must be taken into account: a particular economic activity must contribute to achieving environmental objectives in one of the areas of the taxonomy, a particular economic activity must not harm or cause significant harm in any of the other areas of the taxonomy, it is necessary to respect the UN guidelines in the field of human rights and rights related to the performance of work (the economic activity must not have a negative impact on society), it is also necessary to take into account specific technological criteria related to technical solutions for reducing emissions (*EU Taxonomy Overview*, n.d.). The EU taxonomy has been in force since January 2023. Initially, the climate acts entered into force in January 2022: Climate Change Mitigation and Climate Change Adaptation, and in January 2023, environmental acts, namely Sustainable Use and Protection of Water and Marine Resources, Transition to a Circular Economy, Pollution Prevention and Control, and Protection and Conservation of Biodiversity and Ecosystems (*EU Taxonomy Timeline*, n.d.).

In addition to the EU taxonomy, there are others. Several taxonomies are in force (or about to be introduced), namely in South Africa, Great Britain, Chile, Mexico, Canada, Georgia, Russia, Mongolia, Japan, Bangladesh, Singapore, Malaysia and

China, which has two taxonomies. These taxonomies can be classified according to the area to which they relate, namely green taxonomies relating to environmental issues; social taxonomies relating to social goals; and brown or transitional taxonomies, which are adapted versions of green taxonomies. It is interesting to note that not all taxonomies were created under the auspices of state institutions. The taxonomy in Canada was created under the auspices of the private sector (Cojoianu et al., 2022; Gondjia & Merle, 2021).

Companies in the EU will have to adapt their business processes to transition to sustainable operations. Currently, the EU taxonomy is intended for a specific set of companies but will eventually apply to all companies (*Application of the EU Taxonomy for Companies*, n.d.). Companies will have to determine the suitability of their business processes themselves or through external providers. As an example, the consulting company Triglav Skladi has included the taxonomy tool in its services portfolio through the Clarity AI ESG EU Taxonomy module, which determines the compliance of a specific company's operations with the taxonomy objectives through revenues or investments in fixed assets (CAPEX) or investments in current assets (OPEX). This module classifies a specific revenue category as eligible, partially eligible or non-eligible, based on the degree of alignment with the EU taxonomy. After the revenue categorisation is completed, it is checked whether this revenue significantly harms other taxonomy objectives and whether the required social aspect of workers' rights is considered. The module then sums up the company's eligible, partially eligible and non-eligible revenue shares to determine the compliance of the company's entire portfolio with the EU taxonomy (Uprava družbe TRIGLAV SKLADI, 2021).

2.1.3   Environmental Policy

Several commitments have been made in the field of environmental protection. The Geneva Convention on Long-Range Transboundary Air Pollution has been in force since 1983. The purpose of this convention was to achieve cooperation in limiting, progressively preventing and reducing emissions of air pollutants whose negative environmental pollution impacts extend beyond national borders. The form of pollution was defined as a release that occurs as a result of carrying out activities and has undesirable effects on human health and the environment. The signatories to the agreement committed themselves to adopting measures to reduce pollution,

developing air quality monitoring systems, cooperating in research, and regularly monitoring progress in this area (Urad za Publikacije Evropske unije, 2020).

The Vienna Convention for the Protection of the Ozone Layer, in force since 1988, sets out the principles for protecting the ozone layer. It does not require any commitments from the signatory countries. It only provides guidelines for adopting measures to protect people and the environment from dangerous substances that also damage the ozone layer. The signatory countries have agreed to continue researching the ozone layer to better understand the subject (*Dunajska Konvencija o Varstvu Ozonskega Plašča*, 2019).

The commitment to take specific measures to protect the ozone layer was adopted through the Montreal Protocol. It has been in force since 1989. The Montreal Protocol obliges signatory countries to cease using substances that deplete the ozone layer. The gradual withdrawal of these substances from use also impacts climate change mitigation, as these substances are also greenhouse gases. The Montreal Protocol and its subsequent amendments contain time frames for withdrawing certain substances from use. It is the only UN treaty that all countries have signed (Urad za publikacije Evropske unije, 2019).

The United Nations Framework Convention on Climate Change, in force since 1994, aimed to stabilise greenhouse gas concentrations at a level that would not unnaturally disrupt the climate system (UNFCCC, n.d.). The Kyoto Protocol was adopted to complement the United Nations Framework Convention on Climate Change. The signatory countries committed to limiting and reducing greenhouse gas emissions to achieve the set targets. The more significant burden of reducing emissions was placed on the more industrialised countries. The first target period was between 2008 and 2012, and at the meeting in Doha, Saudi Arabia, a timeframe for the second period was adopted, namely between 2013 and 2020. It served as a bridge between the first commitment period and the beginning of the Paris Climate Agreement. The Kyoto Agreement includes three mechanisms: emission allowances for trading between signatory countries to achieve set emission reduction targets, joint implementation of environmental projects and the Clean Development Mechanism, which involves cooperation with countries that have not signed the Kyoto Agreement (Urad za publikacije Evropske unije, 2021). The signatory countries of this agreement have also committed to strict principles for measuring

actual greenhouse gas emissions to monitor the achievement of the set targets (Urad za publikacije Evropske unije, 2011, 2021).

The Paris Climate Agreement was adopted to improve the United Nations Framework Convention on Climate Change implementation. It is a legally binding international agreement on environmental protection. The social and economic transition to a low-carbon society of individual signatory countries is based on five-year cycles. Based on monitoring the achievement of the set goals, the signatory countries can adjust the adopted measures or prepare new ones. The set goals of the Paris Climate Agreement are to limit the increase in the average global temperature, increase the ability to adapt to climate change and redirect financial flows into sustainable investments (Pariški sporazum, L. 282/43, 2016). The signatory countries also committed to providing financial assistance and technological support to the signatory countries (UNFCCC, 2023). Based on this agreement, Slovenia adopted the Long-term Climate Strategy of Slovenia until 2050 (Državni zbor, 2021).

Based on the Paris Climate Agreement, the EU adopted the European Green Deal as a key document supporting the transition to climate neutrality by 2050. The deal aims to transform the EU into a modern society based on an economy that generates no net greenhouse gas emissions. A just and inclusive transition must protect people from the negative impacts of environmental performance, preserve the EU's natural capital and guide the economy and society towards greater sustainability. The European Green Deal includes the following environmental commitments (Evropska komisija, 2019):

- a commitment to a clean energy supply;
- an industry commitment to a clean and circular economy;
- a commitment to building and renovating buildings with energy and resource efficiency;
- a commitment to accelerating the transition to sustainable and smart mobility;
- a commitment to creating a green food system;
- a commitment to preserving and restoring biodiversity, with a focus on oceans as sustainable smart economies;
- a commitment to working towards zero pollution for a toxic-free environment;
- a commitment to ensuring green finance;

- a commitment to greening national budgets and sending the right price signals (establishing an emissions system based on the polluter pays principle);
- a commitment to putting research findings into practice and fostering innovation;
- a commitment to boosting education and training;
- an intention to take a leading role in sustainable development;
- an intention to develop a carbon adjustment mechanism (to reduce the risk of carbon leakage);
- a commitment to establish an infrastructure for integrating climate change into risk management practices (enabling access to data);
- a commitment to strengthen the production and use of sustainable alternative fuels for transport;
- a commitment to improve public transport or to regulate urban traffic;
- and an intention to develop international standards for sustainable growth.

In support of the European Green Deal, the European Council adopted the Corporate Sustainability Reporting Directive (hereinafter: CSRD) as a framework for channelling private investment into climate-neutral economic activities. The CSRD is based on the principle of dual materiality, whereby a company must assess how sustainability impacts its operations and how the company impacts its surroundings through its activities. This combines financial materiality and materiality of impact. Companies must disclose sustainability information from 1 January 2024, considering new standards for sustainable development and digital labelling (Virjent, 2023). Companies must comply with EU regulations, including taxonomy when providing this information. Sustainable production will thus become one of the key areas for manufacturing companies.

2.1.4   Sustainable Production

The economy is not an end in itself. Society is responsible for economic growth, so it is an action that is socially imposed. The purpose of the economy is to satisfy the community's real needs for products, services and quality jobs. Production processes, relationships within and outside organisations, products, supply chains and sales channels have numerous negative impacts on the environment, which are most often manifested in the following actions (Karba et al., 2016):

– *the impact of the economy on climate change*: as the main contributors to climate change due to the economy, we can highlight the geographical dimensions of supply and supply chains, the massive daily migration between the workplace and home and the associated significant increase in the amount of transport;

– *reduction of the final stocks of non-renewable earth resources (raw materials and fossil fuels)*: the main contributor is the inappropriate use of raw materials and energy in production processes, which can ultimately lead to their depletion;

– *poor quality of air, water and soil and poor habitat conservation*: this can be blamed on wastewater, emissions from industrial processes and supply chains and their spatial requirements;

– *uneven distribution of material wellbeing in the community*: the main contributors are inappropriate ownership and management models of business organisations;

– *absence of added value in the economy*: the contributor is an insufficient level of integration into value chains, lack of expertise and innovation;

– *poor quality of life of individuals:* the main contributors are lack of job security, inadequate level of involvement in management, lack of opportunities for education and training for all, unhealthy working environment and long distances between the workplace and the place of residence;

– *absence of polycentricity, uneven settlement and spatial imbalance of the national territory, suburbanisation and failure to preserve the traditional and recognisable image of the countryside*: the main contributor is the limited availability of jobs in local environments.

Effective and successful coping with the aforementioned challenges is only possible if the community directs its economic activities towards a local circular economy and the community members support it with their consumption patterns. The concept of a local circular economy is based on patterns of living systems powered by the energy of natural resources, whereby organisms that are more energy and resource-efficient are more successful in the struggle for survival. The circular economy is based on a balance between competition and cooperation (symbiosis) and the network connection of its elements. A systems approach is also important, as it, like nature, understands the mutual influences of individual elements within the whole: social context, environment, and infrastructure (*European Parliament*, n.d.).

Companies must transition to new business models that include activities such as establishing production and supply networks with high added value based on local resources, sustainable use of local renewable raw materials and energy sources, avoiding the use and production of hazardous chemicals, promoting social and technological innovations, co-ownership, sharing and co-management, and sustainable consumption. The result of such a change is primarily in the mindset of decision-makers in the economic process, which brings greening of business processes and is manifested in actions for environmental care and the following operational actions: safe, inclusive, stimulating and local jobs, ensuring material wellbeing, caring for social cohesion, preserving the natural environment, sustainable waste management, reducing the community's contribution to climate change and adapting to it, community resilience to external shocks and preserving tradition and strengthening community identity (Karba et al., 2016).

As we saw in the chapter on sustainable production, innovation in production processes is crucial to reducing the environmental footprint and improving resource efficiency. However, sustainability does not end with production; it extends to how products and services reach end users and how resources can be used more efficiently throughout their life cycle. This is where the concept of the sharing economy comes in, representing an evolution in thinking about sustainability.

2.1.5   Sharing Economy

The rapid changes enabled by the continuous development of technologies in the world have led to the development of the sharing economy. It is a product of modern-day capitalism, characterised by the increasing role of technology in people's daily lives and the successful operation of companies. The beginnings date back to the 1990s when social networks began to develop. However, the more extensive global spread of the sharing economy has occurred in recent years.

The concept of the sharing economy represents a new economic model in which the principle of sharing or lending goods – products and services that individuals do not currently need (among people at all social levels) – applies. The sharing economy is a new concept that, instead of the current way of consumption, implements a new approach in which several individuals use one good (such as a bicycle, a car, tools, premises, land, various services, etc.) (*Ekonomija delitve*, n.d.).

Lisa Gansky says that new business models are emerging "that create, share, and use social media, wireless networks, and information from all available sources to provide people with products and services at the moment they need them, without the burdens of ownership." Janelle Orsi defines the sharing economy as "a viable and necessary alternative; we can have access to many of the things we need without owning them (entirely)" (Gansky, 2010). So, the sharing economy is not exclusive and not intended for only a few; it is for everyone.

The sharing economy, if we look at its essence, is a common term for diverse socio-economic models at the local, national and global levels. It provides everyone with easy access to goods – products and services – they need and when they need them, without necessarily having to become their owner or buy them. Therefore, the essential characteristics of the sharing economy are as follows (Kralj, 2023):

- universal access to essential goods (every person on the planet must have access to goods that are essential to meeting their basic needs: food, water, suitable housing, healthcare and education);
- access takes precedence over ownership (we do not need to buy everything we need);
- cooperation takes precedence over competition (the sharing economy is based on cooperation between all participants in the economic process, which is the complete opposite of the traditional economy, where everyone competes against each other);
- solidarity and empathy instead of greed and selfishness (today, it seems to us that greed and selfishness are economically beneficial, but the truth is that they cause immense suffering to millions of people living in extreme poverty).

In recent years, the sharing economy has also expanded significantly in Slovenia. Users are well aware that they will save time, energy and money. Houses, apartments, rooms, spaces for various activities (e.g., AirBnB), land (e.g., parking lots), devices, tools, agricultural machinery and labour (TaskRabbit) are shared or rented. Cars, bicycles, and electric scooters are shared (e.g., Bolt, Uber, Tier, etc.). In the "Zelemenjava" initiative, Slovenian gardeners exchange seeds, seedlings, gardening tips and surplus produce from their gardens, contributing to a more efficient food supply chain. For younger, more conscious generations, exchanging and sharing of goods are becoming a new lifestyle, a rebellion against consumerism, a fight to

preserve the environment (Lozar, 2018) and a transition from ownership to a system of accessibility and the possibility of sharing.

The sharing economy, therefore, enables more efficient use of resources, reduces the need for increased production, and allows for the creation of added value without basing it on the growth in energy consumption or raw material use. This is further developed in the concept of "degrowth".

2.1.6   Degrowth

Degrowth is a socio-economic model that does not require or anticipate persistent economic growth but rather the greatest possible sustainable coexistence or coexistence of man and nature (*Odrast*, n.d.). In contrast to the concept of eternal economic growth, degrowth has been offered as an alternative to a more sustainable model of life. Since unlimited growth is not possible on our planet, we have two options: to continue the existing suicidal growth model or to seek different civilisational patterns.

Degrowth is a concept, a movement, and a way of thinking that reminds us that endless growth on a finite planet is neither sustainable nor desirable, and it is by no means a solution for our society. This concept attempts to understand the intertwining of crises that we face today. With this new way of thinking, we would encourage society to move towards greater social and environmental justice, the general wellbeing of humanity, meaningful living, emancipation and universal autonomy. With this new way of thinking, we would encourage people to consider material goods as a means, not an end, in life. So, how do we actively balance life's economic, social and environmental components both at the level of daily habits and social processes? Degrowth encourages a life where we all take responsibility for our actions. With the paradigm of degrowth, we want to draw attention to the need to change the institutional framework and socio-economic relations, connect different ideas, and encourage the search for new proposals for a better life (Pistotnik, 2018).

The concept of degrowth is based on simplicity, voluntary modesty, and an emphasis on self-sufficiency and non-violence. Degrowth is therefore not only a feasible project for achieving environmental sustainability (for example, through measures to reduce the ecological footprint, limited input of materials and substances into

production and consumption, and moving away from fossil fuels), it is also a concept of social and economic sustainability, a building block for greater social equality, systemic solidarity and democracy (D'Alisa et al., 2019).

The degrowth project includes the sustainable field, prosperity, justice, solidarity and democracy. It is based on simplicity, voluntary modesty, and emphasis on self-sufficiency and non-violence. Therefore, degrowth is not only a feasible plan for achieving environmental sustainability but also a concept of social and economic sustainability, a building block of greater social equality, systemic solidarity, and democracy. Approaches to researching degrowth are different, but the concept is primarily a plan for abandoning enormous economic growth as a social goal, a call for material moderation and simplicity, and a concrete model for radically reducing wealth, income, geographical and intergenerational inequality. It specifically represents a project for absolute quantitative reduction of production and consumption, as well as pressures on the environment in rich countries, while simultaneously searching for a model of social justice with new sustainable, social and political state concepts, mechanisms and instruments (D'Alisa et al., 2019).

Plut (Daugul, 2020) explains that the unbridled increase in production and consumption, the pursuit of material goods, and the constant drive for economic growth are severely disrupting the planet's self-renewal and regenerative abilities. As a result, it may soon no longer be able to provide the optimal living environment it has thus far. He is convinced that we are at a crossroads in civilisation when we must seriously ask ourselves whether we can continue a model of quantitative economic growth that exceeds the planet's capacity.

Has the time come for humanity to "grow up", redistribute the world's wealth and reflect on its values that encourage the constant accumulation of material goods? Here begins the reflection on the concept of degrowth - the idea of a society that has separated itself from the pace of constant growth but provides humans with a decent life in harmony with the many ecosystems and other living beings on this planet.

Degrowth is, therefore, a departure from the necessity of economic growth. However, how can we still ensure material wellbeing? Moving away from all activities that excessively burden the environment and transferring income generation to economic activities that reduce environmental pressures. If we want to achieve

moderate material wellbeing, we need a third message that degrowth brings: the need for the redistribution of wealth on the planet. In other words, degrowth emerged from the need to move away from the model of quantitative economic growth. However, the entire pattern of degrowth also shows that moderate material wellbeing is necessary for a happy and satisfied life. For this, we need a certain progress, a certain increase in the broadly understood quality of life, which is not aimed at a permanent increase in the material standard. Finding niches where shifts towards degrowth can occur will be very demanding. Most of all, the hardest challenge will be redefining our value system. This is where severe challenges await us (Daugul, 2020).

In the circumstances we find ourselves after a century or two of continuous growth, the current dilemma is whether we will transition to sustainable growth or find ourselves in a world where much of nature is destroyed. Life will be unpleasant for most people. The idea of growth is important because it shows and outlines a different potential future, thereby dispelling the slogan that advocates of the existing system have resorted to for decades, i.e., "we have no alternative" (Živčič, 2015).

The logistics and global supply sectors also do not allow for continuous growth, ever-increasing exploitation of natural resources, infrastructure expansion, increased energy consumption, and intensive negative environmental impact. The transition from "asset heavy" to "asset light", one of the more visible trends in logistics, indicates the possibility of a transition to the concept of growth - services instead of ownership, e.g., fleet, shared use of transport containers and freight vehicles. This is also indicated by the desire to minimise costs and environmental impacts during last-mile deliveries and better awareness of the so-called green customers. The view on alternative environmental solutions is also changing, which, to a certain extent, also includes growth concepts that logistics and supply chain managers already see as economically interesting measures.

If the assessment of business performance also included negative external impacts on the environment and society, and external costs, the growth concept would gain even more validity. We could also upgrade the basic economic concept of justifying growth based solely on economic indicators (e.g., gross domestic product (GDP)) with factors that have been proven to affect the quality of life, such as human health (in logistics and transport by reducing PM particles), ecosystem safety (in transport by reducing the risk of toxic chemical and oil spills), social responsibility (in global

supply chains by more responsible behaviour, respect for human rights, gender equality, religion, etc.). In this way, we are also getting closer to an idea of the wellbeing economy.

2.1.7   Wellbeing Economy

A wellbeing economy refers to an economy in which public funds are allocated to improving the wellbeing of citizens. It is based on the idea that wellbeing is a prerequisite for economic growth and social and economic stability. The wellbeing economy (Svet Evropske unije, 2019) can be defined as a set of activities that:

- offer people more opportunities for social advancement and improvement in those aspects of their lives that matter most to them;
- enable these opportunities to develop into outcomes that bring prosperity to all segments of the population, including those at the bottom of the scale;
- reduce inequality;
- and ensure environmental and social sustainability.

The wellbeing economy is an economic model that benefits people and the planet, as well as ensures human dignity and justice. It seeks to go beyond traditional economic indicators such as GDP and include measures of wellbeing to assess progress. It is an economy that "meets the needs of everyone on our planet". The model aims to create social, health, economic and environmental conditions that improve the quality of life of individuals and communities and provide a sense of meaning and purpose (Anielski, 2022).

Investing in people's wellbeing creates the foundations for stronger and sustainable long-term economic growth. Thus, GDP alone cannot be the sole guide for policymakers, as it does not capture all aspects and does not provide a comprehensive picture of a country's economic performance. It is noted that more and more additional indicators are considered when measuring economic performance and social progress, not only the generally accepted GDP indicator (Svet Evropske unije, 2019).

By considering the different aspects of life important to people, policymakers can more easily identify areas with above-average or good indicators, quickly identify key

challenges and critical areas, and thus set priorities more effectively. Many policy areas that are essential for both the welfare and economic growth of a country are analysed through multiple channels (Figure 6) (Svet Evropske unije, 2019):

– **Social protection and redistribution**: contribute to greater socio-economic resilience in society and encourage investment in physical and human capital, thereby contributing to higher economic growth. They affect welfare in terms of income and are associated with higher subjective wellbeing in society. Social transfers protect people from economic instability and help them recover quickly from adverse shocks. This can prevent existing inequality of outcomes from leading to inequality of opportunities for the next generation, particularly in healthcare, education and the labour market. Well-designed social insurance and protection systems, together with active labour market policies and policies for the promotion of labour demand are very effective in protecting individuals while also improving labour market outcomes.

– **Gender equality**: increasing women's employment and working hours would help to increase productivity and GDP. This could further reduce income inequality, improve household incomes during economic downturns and strengthen the middle class. Current trends in life expectancy and fertility rates suggest that women should be more actively involved in the workforce. Furthermore, despite the increase in female employment rates, there are still significant gender gaps in access to quality jobs. Women are more likely to work part-time, receive lower wages and are employed in less profitable sectors.

– **Health care**: health is a fundamental human right and a key factor contributing to wellbeing. Good health affects GDP growth and many other dimensions of wellbeing. It starts with education, as longer life expectancy also means a higher lifetime return on investment in education, while poor health hinders children's cognitive development and lowers educational outcomes. Health is also an important factor for employment and subjective wellbeing. This can be increased by ensuring access to high-quality health care for all segments of the population (for example, expanding the scope of services covered by primary health care, prevention, systematic and support programs, reducing stress in the workplace, policy measures to improve nutrition and physical activity, etc.). Inequalities and stratification in the population are thus reduced with appropriate health policies.

− **Education and training**: longer and better education affects GDP growth and many other dimensions of wellbeing. For example, highly educated individuals in OECD countries live on average 6 years longer than those with low education. They have higher employment rates, lower job insecurity and lower job stress. However, more extended education can also have a negative impact on work-life balance. Attempts to quantify the total net impact of education on wellbeing show that investments in education are more than twice as profitable when health and employment benefits are considered.

Global economies are facing inequalities that harm the environment and society, making fundamental change essential to achieving prosperity for all. The EU plays a key role in this process, as it is one of the largest economic blocs in the world, with a historically strong social commitment and a desire to take the lead in respecting human rights and a quality living environment. Inter- and intra-state injustices, growing social, economic and political inequality, and an excessive focus on economic growth create social crises. These challenges must be addressed to achieve a socially and environmentally just economy. Environmental crises are closely linked to inequality, as wealthier individuals create a significantly higher environmental footprint. In the climate crisis, for example, the wealthiest 10% of the world's population is responsible for 52% of total carbon emissions (Oxfam Germany e.V. & European Environmental Bureau, 2021).

A socially and environmentally just economy must be based on three pillars: dismantling exploitative structures, democratising the economy, and transforming economic growth. Only in this way can we create a world where everyone benefits from prosperity and nature is respected and protected (Oxfam Germany e.V. & European Environmental Bureau, 2021). The economy's focus on wellbeing includes ensuring a fair distribution of resources, prosperity, and sustainability and building resilient communities that develop their capacities and are ready to overcome challenges. An important step towards establishing and recognising this economic model occurred in 2021 when over 500 experts at the World Health Organisation (WHO) international conference adopted the Geneva Charter for the Economy of Wellbeing. This document encourages policymakers and world leaders to take the economy of wellbeing into account and adopt concrete measures and additional indicators that would change the dominant way of assessing the performance of economies.

Figure 6: The Economy of Wellbeing: going beyond GDP
Source: (Evropski svet, 2021)

It is a move from a single indicator to a broader set of indicators, including social and environmental indicators. European countries are encouraged to adopt this economic model by the WHO Venice Office, which is committed to creating fairer and healthier environments and communities for all people (WHO, 2021).

In addition to knowing the basic concepts of sustainable development, a meaningful upgrade of knowledge requires the development of lifelong learning and, last but not least, making strategic decisions. In logistics companies and supply chain management, it is also necessary to be well aware of trends in the field of sustainability and digitalisation. Knowing the trends allows us to anticipate possible future scenarios, which can help us make the right strategic business decisions and allow us to create more resilient and responsive supply chains.

2.2   Sustainability Trends

In the last few years, words like "sustainable", "green", "circular", and other related expressions have become increasingly popular. Companies are trying to act socially responsible because this is expected by the state and increasingly by conscious consumers. People are becoming increasingly aware of the importance of a friendly attitude towards the environment and the new challenges of climate change, pollution, social responsibility and the circular economy. However, since we perceive a lack of knowledge and skills to solve sustainability challenges, the first step is to identify the necessary skills we will need to solve sustainability challenges.

The fact is that these topics are being increasingly researched, written and talked about. However, what are the actual shifts that are happening and have happened in this area? What are we doing and what will we do as individuals, and what are companies doing or will do to promote sustainable behaviour? Below, we analyse in more detail some key trends in the field of sustainability, such as a) sustainable consumption, b) green consumers, c) ESG and carbon neutrality, and d) education in sustainability. The latter includes the principles of the sustainable development paradigm, environmental awareness, environmental protection, social responsibility, active citizenship, critical thinking, etc. Equipped with these skills, future experts and decision-makers will solve sustainability challenges and co-create a socially responsible and more environmentally friendly future more easily. Sustainable education, however, encompasses more than just a traditional academic approach; it is based primarily on interdisciplinary study, problem-based learning, real challenges,

and participatory work. It emphasises the importance of systemic thinking and the complexity of the challenges being studied.

2.2.1 Sustainable Consumption and Green Consumers

Sustainable consumption encompasses lifestyles, purchasing habits, and the use and disposal of products in a socially responsible and environmentally friendly manner. Sustainable consumption aims to meet consumers' needs for products and services, helping them achieve a better quality of life while using less materials and energy and producing less waste. At the same time, it is necessary to create financial savings, build fair relationships in supply chains, and reduce global injustices. Any changes in thinking are strongly influenced by the values that prevail in the community, followed by information and awareness of individuals. A deeper understanding of the relationship between consumption patterns and the scarcity of natural resources is essential, as is understanding the connection between consumption patterns, people's working conditions, and fair pay.

The primary purpose of modern supply systems is not to increase profits but to develop equitable relations, connect rural and urban areas, and provide high-quality products. Systems established in this way respond quickly to all the challenges and needs of society and the environment.

When we look at sustainable consumption from the perspective of an individual user, there are a few rules that everyone can follow and thus contribute to more sustainable behaviour. The first rule is thoughtful purchase – careful deliberation about whether we need the product. This is followed by the second rule, which is reuse – can I use the product in another way, or can I buy the product second-hand? When the product no longer serves the user, they can sell or give it to someone, this being the third rule – reuse. For occasional work (e.g., apartment renovation), it is more sustainable to rent the tool and thus follow the fourth rule – borrow. The fifth rule directs the user to pay more attention to the quality of materials and thus to the decision to purchase higher-quality products with a longer lifespan – quality over quantity (Okorn, 2020). Shifts in key areas are also evident in various research and statistical results. These trends are being and will continue to be followed in the future by both end users and companies.

In the field of green consumers, there has been a ***growing trend in electric and hybrid vehicle use*** in recent years. Research shows that the costs for users of electric and plug-in hybrid cars in Germany, compared to conventional cars, decrease on average by 14% and 26% per year (Weiss et al., 2019). From 2020 to 2021, the number of registered electric passenger cars increased by 47%. The number of hybrid vehicles also increased by as much as 70%. Electric passenger cars and hybrid vehicles represent 1.8% of all registered passenger cars in Slovenia. The number of newly registered new electric and hybrid passenger cars is also growing (Figure 7) (Gostiša, 2022).
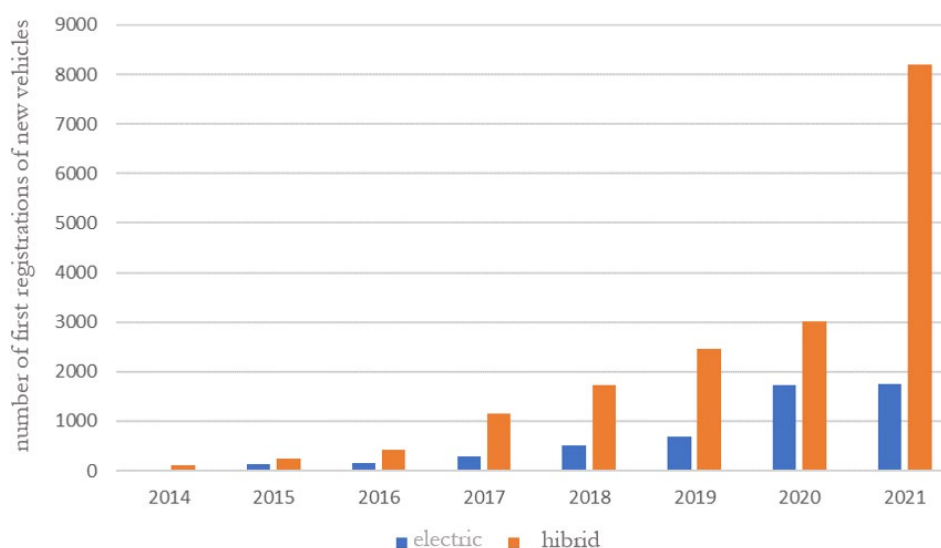
Figure 7: Number of first registrations of electric and hybrid vehicles in Slovenia
Source: (SiStat, n.d.-a)

One way to raise awareness and move towards more sustainable behaviour in active mobility is to promote cycling and walking, where possible. The Netherlands, which is known as a country of cyclists, stands out as a country successfully following the trend. To raise awareness of active mobility in children, parents could organise trips/holidays with public transport. When purchasing new vehicles, we can take Norway (Richter, 2023), famous for the most registered electric cars, as an example of good practice in integrating electric vehicles. We must be aware that no car is as environmentally friendly as the one we do not use at all. The more environmentally sustainable path is to reduce the need for mobility, localise, promote active mobility

and use public transport. It is necessary to be aware that a private car is a luxury good that not everyone can afford in the future and, together with the associated necessary infrastructure, causes serious environmental impacts.

Recycling has been discussed for many years. Compared to other European countries, Slovenia ranks above average in plastic packaging recycling (Figure 8). Recycling in households is already a common practice, yet it calls for further attention and action. We are currently in a phase where there is much talk about waste recycling. Much of the waste is recycled, but less of it is processed and reused. However, we as a society are far too inactive in preventing waste generation and changing consumer lifestyles.
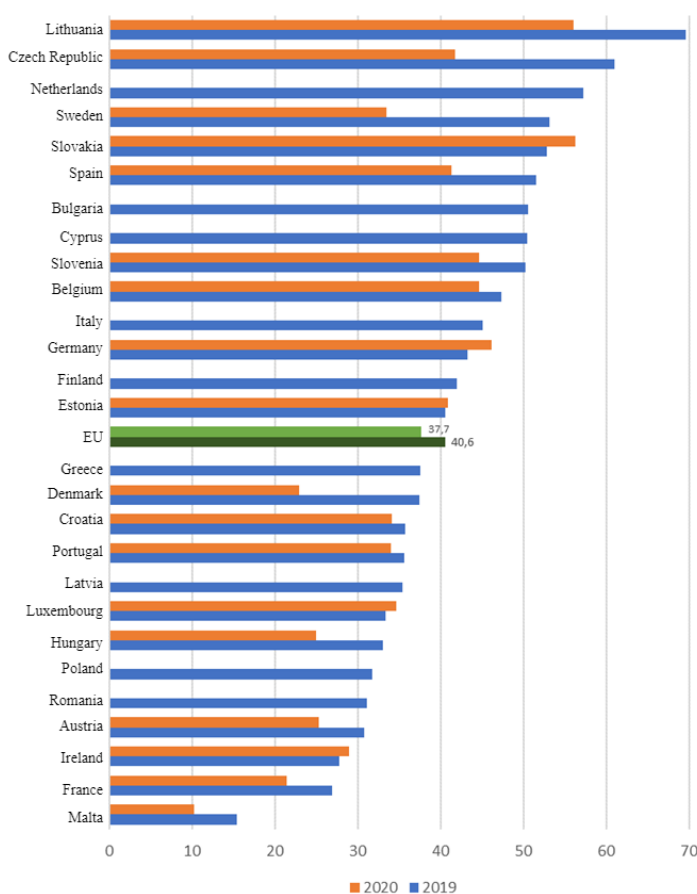
Figure 8: Percentage of recycled plastic in 2019 and 2020
Source: (SiStat, n.d.-a)

Given that 4.8 tonnes of waste per EU inhabitant were produced in 2020, the focus on recycling is undoubtedly important (Eurostat, 2023a). In this area, education and the right information about recycling will need to be emphasised. We have materials such as glass and aluminium, which have a high recycling rate, and various types of plastic labelled as suitable for recycling. However, this is often impossible due to their different compositions, technological processes and legal restrictions (Wakefield, 2022). Figure 9 shows predictions for the future, showing that 91% of plastic waste is still a challenge (Mckay, 2023). By focusing on this topic, we want to raise awareness among consumers to pay more attention to the product's composition and packaging before purchasing it and thus help ensure that the latter can be reused, processed or recycled. In this way, companies will also be forced to produce more environmentally friendly packaged products, as consumers will prefer them to others. Logistics companies perceive sustainable packaging as one of the priority areas they will address and invest in over the next five years.
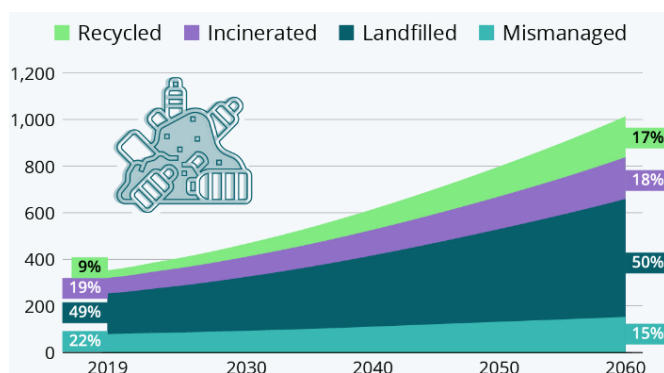
Figure 9: Waste plastic recycling forecast
Source: (Fleck, 2022)

The next concept we describe is the concept of the circular economy, which represents a life without producing waste or in minimal quantities and encourages circular material flows. This means that what is useless to someone becomes useful to someone else (Figure 10). Until 1950, lifestyles were such that natural resources on Earth could be renewed faster due to their lower consumption. Today, the ecological footprint exceeds 56% of the Earth's biological regeneration capacity ('Six Sustainability Trends to Watch in 2022', 2022). The awareness of end users needs to be raised to a level where, for every product, we consider whether we can borrow/rent/need our own, whether it can be used for another purpose, whether

we can donate it to someone else for use, etc. New business models will be much more based on usage than ownership, as the sharing economy allows us to use resources much more efficiently and reduce product costs (e.g., transportation, vacation accommodations, fitness, laundries, etc.).

Figure 10: Circular economy process
Source: (Evropski parlament, 2023)

The circular economy will gain importance as one of the EU's strategic priorities in the future. Significant financial resources will be provided for the transition to a circular economy. However, it is important to be aware that the transition to a circular economy is justified because the EU is not rich in strategically important resources (e.g., rare earths, metals, fossil resources, etc.). However, we do have technologies for processing waste from which a certain share of resources can be returned for reuse.

Individuals can significantly contribute to a more sustainable lifestyle in many areas, from reducing waste to promoting a circular economy, above all in the field of nutrition. Studies show that the demand for meat products will increase by **50%** between 2013 and 2050 (*Global Meat Consumption, World, 1961 to 2050*, n.d.). A comparison between the production of meat products and comparable plant-based products shows   that by consuming plant-based products, we can help reduce greenhouse gas emissions by **30%** to **90%** (*Plant-Based Meat for a Growing World*, 2019).

Replacing meat with legumes means higher nutritional quality and lower costs and environmental impacts (Gazan et al., 2021). Figure 11 shows a comparison of emissions according to the food we produce. Everyone can contribute much to sustainable behaviour through their eating habits, even if they start by introducing one meatless day a week. Certainly, sustainable behaviour also means buying locally produced food. However, first and foremost, it is essential to be aware of the environmental impacts of individual types of food and international logistics, the impact of intensive plantation farming on local ecosystems, and the possibilities of alternative eating habits. Education in environmental impacts, monitoring environmental impacts, critical thinking, and finding solutions are becoming essential for the green transition.
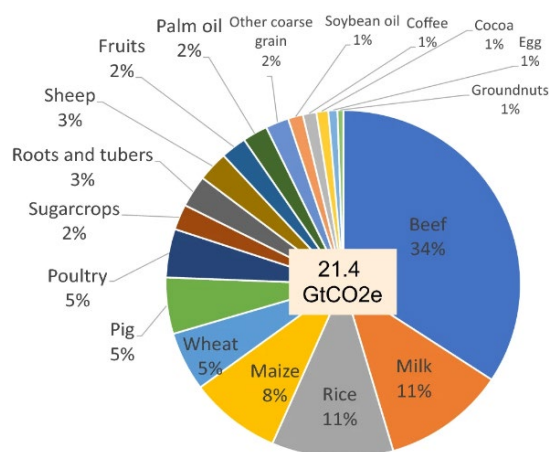
Figure 11: Emissions in global food systems in 2020
Source: **(**Costa et al., 2022)

As already mentioned with food, we can also become more sustainable consumers when it comes to our wardrobes. We can focus on the materials from which clothes are made, and above all, buy fewer clothes of better quality. This is very important because, on average, in Slovenia, we throw away 12 kilograms of clothes per capita per year (B.R., 2021). The positive news is that **38%** of customers are already giving up their favourite brand and opting for a more environmentally friendly brand (*10 Sustainability Trends to Watch in 2022*, 2021). High-quality and environmentally friendly materials include organic cotton, linen, industrial hemp or lyocell. We can also be sustainable from the perspective of reuse. Figure 12 shows the increase in the purchase of second-hand clothes, especially among younger generations. We can

also sell or donate clothes that no longer serve us (Macarol, 2022). This is also creating new business models and online platforms that we will need to pay attention to in the future, as they promote the idea of degrowth and sustainable business by generating profit that does not rely on the consumption of scarce resources and energy. As individuals, we can decide to buy second-hand; we can donate/sell clothes instead of throwing them away. If we get tired of clothes, we can exchange them with friends and organise a "clothes swap event". Equally important is the mindset of "fewer clothes of better quality".
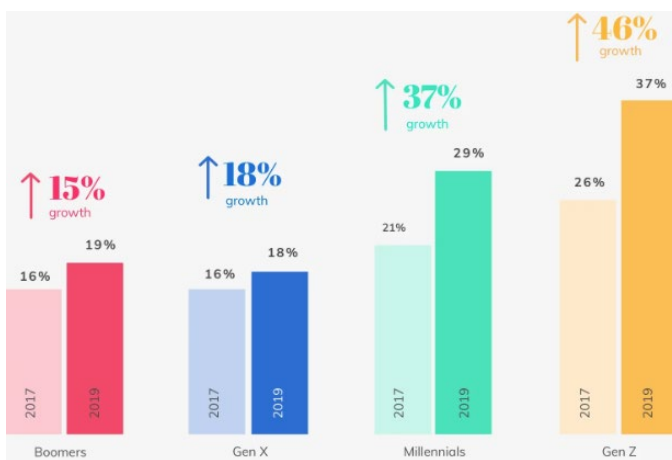
Figure 12: Proportion of second-hand clothing purchases by generation between 2021 and 2022
Source: (Fleming, 2019)

Green consumers increasingly attribute greater responsibility to brands for advancing global sustainability. According to research, 46% of end users expect brands to lead in creating sustainable change ('Trend Watch 2023', 2022). As consumers, we have a choice when purchasing finished products. This choice alone can help us act as green consumers by asking how a product got to the shelf, whether it has a sustainability label, whether it is locally sourced, etc. In doing so, we support sustainable brands.

Working from home has become the norm for many employees practically overnight with the outbreak of the Covid-19 pandemic. During the pandemic, **35.4%** of employees worked from home, with the percentage now decreasing and reaching 7.7% in April 2022 (Richter, 2022). Although most employees work on-

site, as Figure 14 shows, the percentage of those working from home or in a hybrid model is expected to increase. Working from home can help reduce environmental pollution by reducing the need for transport, thereby affecting energy consumption and, last but not least, helping to achieve a better work-life balance. Working from home is often largely a matter of organisation and also allows for direct reductions in greenhouse gas emissions from transport.
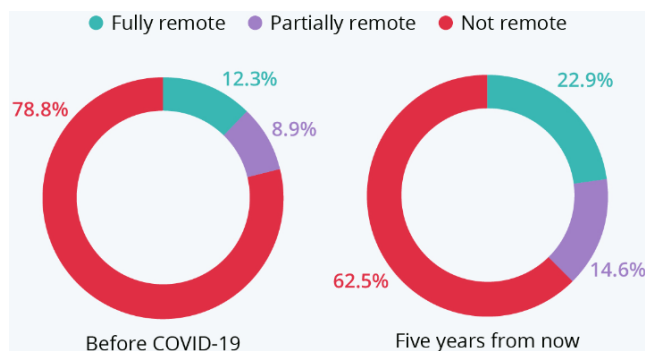
Figure 13: Working from home, hybrid and on-site – before COVID-19 and in 5 years
Source: (Roper, 2020)

The EU's goal is to become a ***climate-neutral continent*** by 2050. In line with this goal, the necessary measures are being taken, among which energy generation is a priority, as energy production is the most carbon-intensive industry in the EU (Eurostat, 2023b). Figure 14 shows the share of energy generated from renewable energy sources in 2021. In 2020, 3,947 new solar power plants with a total capacity of 55 MW were installed, almost 60% more in number than in 2019 and almost 80% more in power (Ekart, 2023). The growth trend in production capacity and the share of energy generated from renewable sources has been further accelerated by disruptions in gas supply, unreliable supplies and high prices. Slovenia also follows the EU strategy and supports the co-financing of sustainable investments in green energy generation. This supports the country's goals of achieving at least a 27% share of renewable energy sources by 2030. Knowledge of sustainable energy supply, the possibility of energy self-sufficiency and energy management, due to EU policy, rising energy and energy prices, and unreliable supply, is becoming a new critical point not only in the operations of many logistics and manufacturing companies, but also in the steel and metallurgy, paper industry and other energy-intensive industries. There is also a desire for awareness among individuals and households

who want to contribute their share to a more sustainable and reliable energy supply in the future.
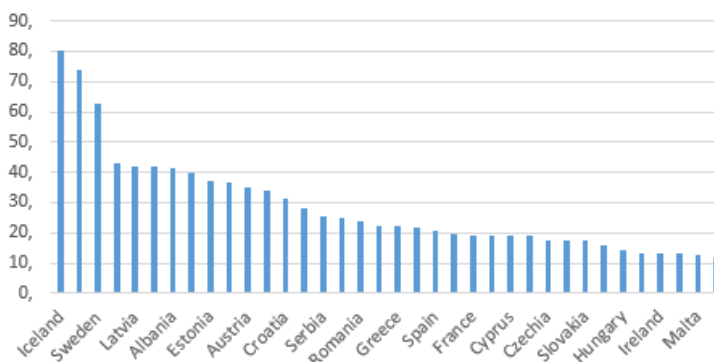
Figure 14: The share of energy obtained from renewable sources in 2021
Source: (Eurostat, 2023d)
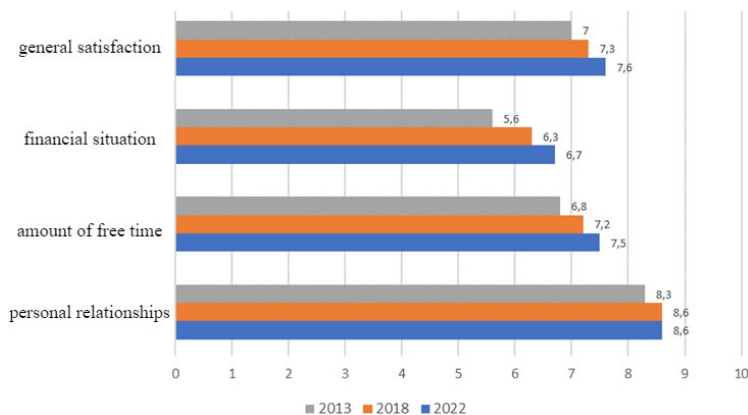
Figure 15: Level of wellbeing in Slovenia
Source: (Adapted from Kebe & Stare, 2023)

Sustainability can also be linked to wellbeing, which, in addition to financial indicators, also includes environmental and social indicators. Figure 15 shows a comparison of wellbeing in Slovenia between the years 2013, 2018 and 2022. The results show that wellbeing in Slovenia has been growing over the years. For all four indicators, which include personal relationships, the amount of free time, financial stability and general satisfaction, the score on a scale of 1 to 10 (where 10 means the highest level of satisfaction) is growing and was highest in 2022. In Slovenia, people

are most satisfied with personal relationships (Kebe & Stare, 2023). Nevertheless, in our research, we detect an extraordinary desire to learn about the field of sustainable development (circular economy, sustainable energy self-sufficiency, environmental assessment, environmentally friendly travel and transport, and better knowledge of climate change).

The areas of sustainability highlighted in this chapter, both among individuals and society as a whole, demonstrate exceptional potential for sustainable education, including knowledge in environmental protection, social responsibility, environmental awareness, sustainable action, problem-solving and critical thinking. Sustainable education should go beyond the conventional approach to education and equip participants with interdisciplinary skills for sustainable action, which will primarily enable successful critical coping with the frequently observed environmental brainwashing (the so-called greenwashing), with which organisations try to sell consumers an unsustainable solution with a false or incomplete definition. A critical assessment of the environmental impacts and benefits of individual products, processes and activities is only possible if we are familiar with the methods and approaches for environmental assessment, environmental protection concepts, and environmental legislation and can think systemically. Environmental impacts are often hidden in very remote parts of the supply chain and are not visible to the end consumer (e.g., water bottles, fur clothing).

2.2.2   Sustainable Operations in Companies

Sustainable operations are becoming a priority for companies and organisations that, due to rising resource prices (materials, energy), emission costs, stricter legal regulations, the introduction of environmental standards, environmental labels or the trend of green consumers, are following the sustainable development paradigm. The ability to manage sustainability challenges and a good understanding of environmental protection, environmental impacts, and environmental assessment are becoming increasingly sought by global supply chain organisations. In 2024, the Corporate Sustainable Reporting Directive (CSRD) will require systematic annual sustainability reporting from large companies in the EU. Large companies will be followed by medium-sized companies in 2026. As the demand for environmental knowledge is growing exponentially, and as we are increasingly aware of the negative consequences of human activities on the environment, education for sustainable development has been identified as the only path to a sustainable green future. Even

small companies exempted from the CSRD directive will be indirectly included as business partners, logisticians, suppliers, transporters, warehouse workers, distributors, and other large and medium-sized companies. This means they will also actively participate in environmental assessments, collect and transmit the required environmental data and monitor specific environmental indicators. The need for knowledge in the field of sustainability will thus lay the foundations for systemic reforms and systematic sustainability education, both within formal education and for lifelong learning. Decision-makers in companies are primarily employees who completed their educational path a decade or more ago, when sustainability, green and digital transitions were not yet topics that would be covered to a greater extent in higher education. They typically need this knowledge or will need it in the next five years to perform their tasks.

The ESG (environmental, social, and corporate governance) framework represents a company strategy. It is a collective term for managing and monitoring the impact of companies on the environment and society. It covers a company's detailed and transparent management in terms of leadership, executive compensation, oversight, internal controls, and shareholder rights. It measures how companies integrate environmental, social, and governance practices into their operations as well as the business model, its impact, and its sustainability (Lambert, 2022). Figure 16 shows trends for areas offering investment opportunities for companies over the next five years.

Researchers in this field point out the need to regulate ESG compliance. They believe that national governments should consider introducing a system of ESG rewards and penalties, including preferential policies such as tax cuts, subsidies or discounts for those who achieve emission reductions through green technological innovations and improved credit ratings. This creates conditions for companies to implement green innovations and achieve quality development. As an example, they propose establishing an ESG negative list system to punish companies with low ESG performance, namely through measures such as lowering credit ratings, reducing loan amounts, and increasing tender conditions (Wang & Sun, 2022). A similar system is also envisaged within the EU taxonomy. For this reason, we can argue that knowledge of environmental legislation, environmental protection concepts, monitoring environmental impacts, and finding alternative solutions will also directly affect the financial performance of companies in the future. Here, we can relate to company strategy and employees' sustainable competencies: the more

companies invest in new staff competent in sustainable business, the more a sustainable culture will develop within the company, allowing them to tackle sustainable development challenges more successfully.
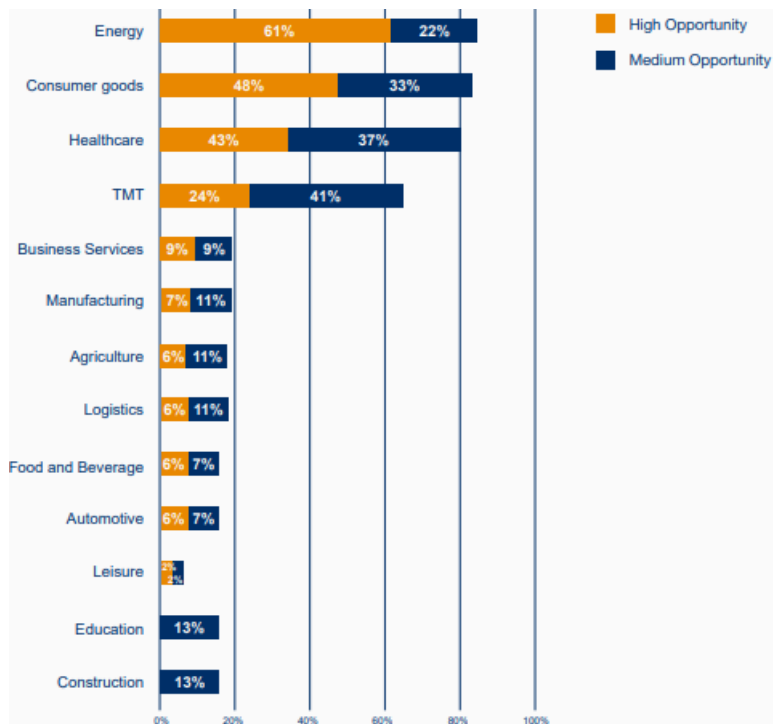
Figure 16: Areas with business investment opportunities
Source: (The Sustainability Institute by ERM, 2022)

Slovenia was below the European average in 2021 regarding material reuse or circularity (Figure 17). We can see that only 11% of materials were reused and compliant with the principles of circularity. Companies can contribute to circularity by choosing materials, raw materials, and suppliers, using advanced technologies and environmentally friendly packaging, choosing how electricity is produced, etc. Circularity is an innovative way of doing business that can simultaneously improve sustainability and profitability. For companies, a circular economy means implementing principles that eliminate waste and pollution, keep products and materials in use, and restore natural systems. One of the straightforward examples of circularity is refusing bottled water and drinking tap water in a glass, which is practically eternal.
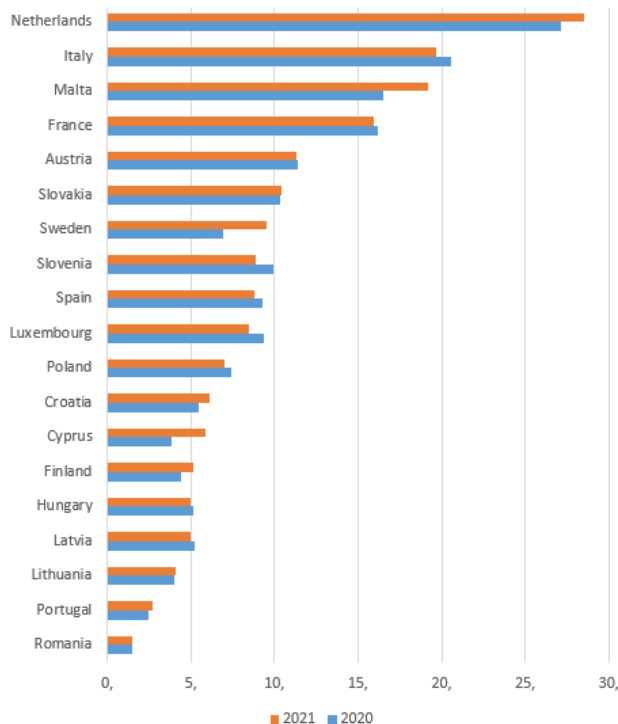
Figure 17: Material reuse rate for circular economy needs in 2020 and 2021
Source: (Eurostat, 2023c)

Research has shown that the impact of downstream supply chains on emissions is more than five times greater than that of direct business activities (Lambert, 2022). **Supply chain management** is already a cornerstone of many companies' sustainability strategies. However, action is accelerating as companies strive to implement more comprehensive strategies and action plans for suppliers and waste management (The SustainAbility Institute by ERM, 2022). Studies are being prepared in the field of supply chains, focusing primarily on responsible consumption and production, industry, innovation and infrastructure, and affordable green energy.   The next focus area is on sustainable cities and communities (Lazar et al., 2021). Supply chains can become sustainable through collaboration between companies and digitalization of process management.

In the field of packaging, there is a growing desire among consumers for companies to act more sustainably. Research has shown that 86% of younger consumers (< 45 years) are willing to pay more for **sustainable packaging**, 57% of consumers are

"less likely" to buy products in harmful packaging, and 74% of consumers said they would be interested in buying products in refillable packaging (Trivium Packaging, 2022). The use of sustainable packaging is a strategic decision for a company. Companies that pay attention to sustainable packaging and have appropriately trained staff can quickly find solutions. Companies also have a choice in selecting suppliers, where they can choose a supplier that emphasises sustainability and offers environmentally less problematic or even environmentally friendly materials, components, and raw materials.

Green energy for companies means transitioning to renewable energy sources, such as sunlight, wind or water (Lambert, 2022). According to the data, the share of energy from renewable sources in Slovenia's final gross energy consumption in 2020 was 24.16%, or 2.2 percentage points more than in 2019 (Rutar et al., 2021). Since a trend of growth in renewable sources and efficient energy use has been detected, in the future, education will need to be adjusted to highlight the advantages of dispersed renewable energy sources, rational energy use, the concept of energy storage, P2G and the inclusion of "prosumers" in the electricity supply. The foundation of a sustainable energy supply is broader than the transition to green energy. Sustainable energy supply chains should first be based on energy saving and rational use, energy efficiency, and only then on the transition to renewable sources.

Less business travel is another trend brought about by the COVID-19 pandemic and has proven to be positive for all business stakeholders. With the pandemic, companies have discovered that business meetings can be more effective in many cases if conducted online. The positive effects of less business travel are cost efficiency, time efficiency, and fewer carbon emissions, 90% of which result from business trip flights (Lambert, 2022). The epidemic period has shown that we can be more successful with online meetings, and certainly more sustainable and cost-effective. Some countries are now banning short flights, which are almost uncompetitive in time with more environmentally friendly rail or bus transport. Certain companies, however, are also enabling a significantly lower environmental footprint for business trips with a sustainable mobility strategy (e.g., mandatory use of public transport for trips shorter than 700 km) and mobility as a service (e.g., shared mobility).

Technology also plays a significant role in sustainability. In the future, companies will increasingly use artificial intelligence (AI) to help them achieve sustainability goals. However, there is also a considerable pollution problem when developing and training AI, as seen in Figure 18 (Gill, 2022). Technology is key to measuring the environmental impact of companies, and with advanced and cleaner technologies, companies can successfully optimise processes and reduce emissions, automate their activities and become more environmentally friendly.
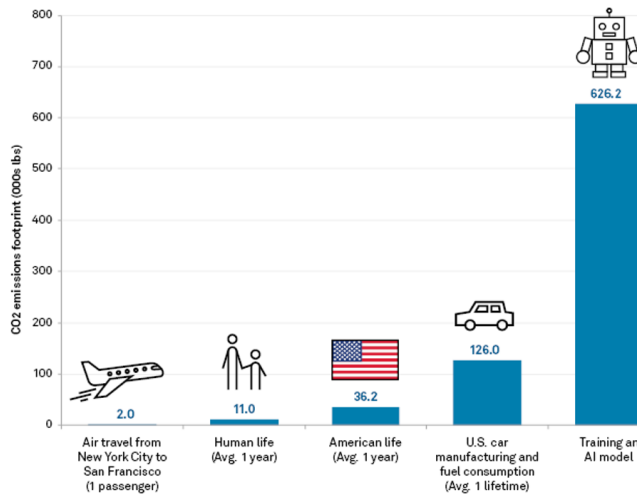
Figure 18: The volume of emissions from different sources
Source: (Gow, 2020)

Air pollution was estimated to be responsible for 6.7 million deaths worldwide and 197,000 deaths in the United States in 2019 (Landrigan et al., 2022). The primary source is the combustion of fossil fuels used for transportation, industry, and, last but not least, electricity generation (Urednik, 2021). In the past, companies were mainly given guidelines on how to reduce their impact on climate change. Now, increasingly stringent criteria apply, which are increasingly regulated by law, meaning that companies are forced to operate by regulations and are penalised if they do not. Sustainability reporting is a key part of any sustainability strategy and is essential for correctly disclosing climate change impact data (Swallow, 2022). Activities to reduce and adapt to climate change in companies encompass various concepts, such as optimising one's carbon footprint, following the zero-waste concept, introducing cleaner technology, operating without paper, encouraging suppliers to behave sustainably, developing products based on eco-design, etc.

As companies have recently focused more on advanced technologies and efficient processes, the trend towards *focusing on human capital* will prevail in the future. The focus on human capital represents the eighth goal of the 2030 Agenda for Sustainable Development, which aims to promote sustainable, inclusive and sustainable economic growth, full and productive employment and decent work for all. The goal mainly covers occupational safety and fair pay (*Uresničevanje Agende 2030*, n.d.). From a sustainability perspective, companies can organise employee training and ensure employee wellbeing and work-life balance.

Through carbon emissions and the consumption of natural resources, we are affecting biodiversity to such an extent that the populations of mammals, fish, birds, reptiles and amphibians have decreased by 68% in the last 50 years ('Six Sustainability Trends to Watch in 2022', 2022). The EU strategy, therefore, calls, among other things, for a 50% reduction in pesticide use and planting of 3 billion trees across the EU by 2030 (Evropska komisija, 2023). Figure 19 shows how the number of endangered species has increased over the years. The loss of biodiversity can directly affect companies. For example, products may become unavailable or unreasonably expensive due to increasing supply shortages. This is evident in the case of certain wood products, where once common wood species are becoming rarer or no longer available in the same dimensions as in the past (e.g., the restoration of Notre-Dame Cathedral in Paris was halted after the fire because suitably large trees were no longer available to make the key roof beams). Companies can help increase biodiversity by measuring their environmental impact, tracking environmental targets and finding solutions for the green transition. This highlights the importance of collaborating with other stakeholders within the supply chain (vertically) or with competing companies (horizontally), as sustainability challenges require a systemic approach.

The carbon footprint is the sum of all greenhouse gas emissions directly or indirectly caused by an individual, organisation, country, event, product or service. Carbon footprint assessment is one of the tools for environmental assessment. It is the first step towards the possibility of reducing emissions, so companies need to be aware of the importance of its reduction (López et al., 2023). Figure 20 presents various strategies that will, in the proposed proportion, influence the achievement of the carbon neutrality target by 2050. Renewable energy sources and electrification will have the most significant impact (54%). Some measures to reduce emissions that companies can implement include investing in clean energy technologies, planting

trees, switching to an electric or hybrid vehicle fleet, reducing the number of business trips, using the concept of "mobility as a service", using recycled materials, etc.
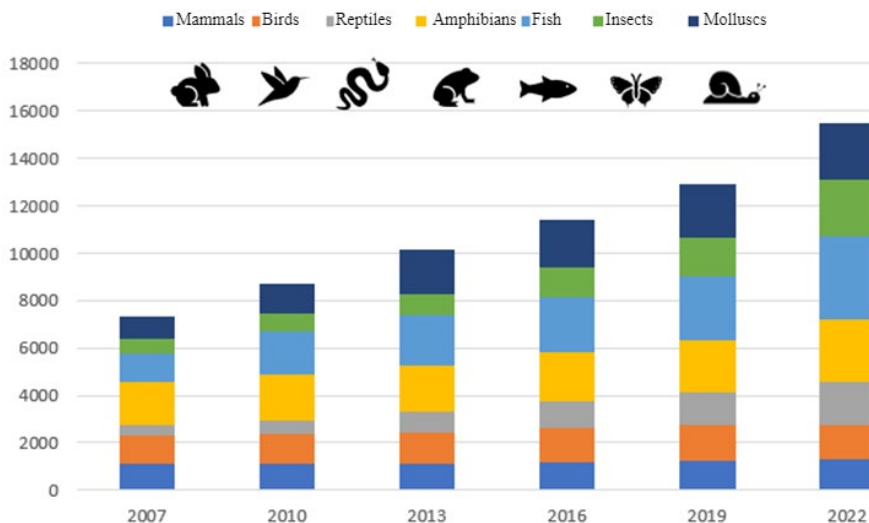
Figure 19: Number of endangered species (impact on biodiversity)
Source: (*The IUCN Red List of Threatened Species*, 2022)
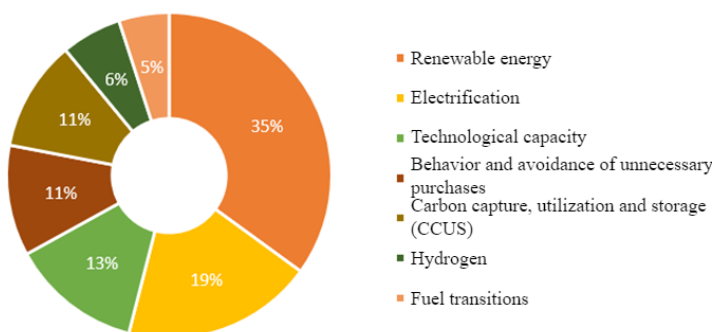
Figure 20: The impact ratio of different strategies to achieve carbon neutrality by 2050
Source: (IEA, 2021)

2.3   Digital Media, Social Networks and Society

Digitalisation is a strategy or process of using digital technologies to profoundly change the core of business models, where the changes lead to opportunities for greater company efficiency (*What Is Digitalisation?*, 2022). Digital techniques are

responsible for transforming various companies and areas of operation, such as the service and information industries, logistics (Toivonen & Saari, 2019) and, last but not least, consumer culture (Lehdonvirta, 2012). This consequently changes mass and social media (van Dijck, 2013), which are closely connected to people's everyday lives. Social networks are defined as "forms of electronic communication (such as social networking sites and microblogging) through which users create online communities for the exchange of information, ideas, personal messages and other content (videos ...)" (*Definition of SOCIAL MEDIA*, 2023).

Digitalisation and social networks cannot escape trends that change or even replace each other almost daily. The human need for communication on a global scale represents a story about establishing and nurturing personal connections at a high level. It is the so-called fuel for developing both digital technologies and social networks.

2.3.1 The Origin and Evolution of Social Networks[2]

The origins of social media could be traced back Morse code (Rosenwald, 2021) in 1844. Most accounts of the modern origins of today's Internet and social media point to the emergence of the Advanced Research Projects Agency Network (ARPANET) in 1969. The United States Department of Defence created the digital network, allowing scientists at four interconnected universities to exchange software, hardware, and other data.

In 1987, the direct predecessor to today's Internet was created when the National Science Foundation launched a more robust, nationwide digital network known as NSFNET. In the 1980s and 1990s, the growth of the Internet enabled the introduction of online communication services such as CompuServe, America Online, and Prodigy (Shah, 2016). Users were introduced to digital communication through email, bulletin board messages, and real-time online chat. These were the earliest social media networks, starting with:

- the short-lived profile-uploading service SixDegrees.com (1997);
- Hot or Not (2000), a website where users could upload their pictures and others would rate their attractiveness (the website later evolved into the Chat & Date application);

---

[2] Summarized from *The Evolution of Social Media* (2020).

- Friendster (2001), which was initially intended as a dating website;
- weblogs or blogs, another form of digital social communication, which became popular with the introduction of the LiveJournal publishing site and the Blogger publishing platform (1999);
- LinkedIn (2003) and Myspace (2003 – 2010);
- Facebook (2004);
- YouTube and Reddit (2005);
- Twitter (2006);
- Instagram and Pinterest (2010);
- Snapchat (2011);
- Vine (2013 – 2017);
- and TikTok (2016).

In addition to websites and networks, various well-known phrases, functions, and even new types of digital languages have been developed. These include, for example:

- GIF (Graphics Interchange Format), invented in 1987 by Stephen Wilhite and popularised in 1995;
- the emergence of the "hashtag" feature, proposed in 2007 by American blogger and product consultant Chris Messina via Twitter;
- YOLO (You only live once) – first used in 1993 in a trademark filed for YOLO gear, popularised in 2011 by Canadian rapper and singer Drake;
- selfie – the first official 'selfie' was created in 1839 (Robert Cornelius), and the word was first used in 2002 (Nathan Hope);
- and emoticons/emoji/smileys (first created in 1999 - by Japanese artist Shigetaka Kurita (Pardes, n.d.), legitimised as a digital language in 2010).

2.3.2   Social Media and Platform Trends over the Years

In 2009, we witnessed the exponential growth of social media. Even then, social media was becoming less social. Various communities, groups, lists, and niche networks emerged, giving a sense of "exclusivity." Perhaps social networks were not less social, and it only seemed that way. Alternatively, this is because people have come to terms with extracting value from networks (Armano, 2009).

In 2015, social media strove for the dominance of real-time video and for the growth of video posting and consumption. Below are some of the significant trends of the time (De Abreu, 2015):

- live video streaming on various social media platforms such as Twitter, Snapchat and Facebook;
- GIFs, emoticons and filters have penetrated the market in the form of posting, short video creation and geo-filters;
- content is starting to be shared as open and restricted content;
- more ad formats in the form of company ads on Facebook, 10-second video ads on Snapchat and interactive features on YouTube;
- increase in consumption through the introduction of shopping applications on social media (shopping ads on YouTube, "Shop Now" feature on Twitter and the like);
- publishing and curation tools that allow the publication of articles and selected popular content;
- and the battle for video supremacy has flared up through various video content-sharing upgrades, such as video autoplay or looping.

Undoubtedly, video content has always been a popular medium for many brands (Moth, 2015) and users, as the latter can learn all the necessary information about the presented content (product or service) visually quickly.

Over the past decade, social media has established itself as a thriving, multifaceted community, with billions of people worldwide active daily. More than 90% of millennials use at least one social platform, and more than 85% of Gen Z learn about new products through them. Many entrepreneurs believe social media is an efficient part of their business activity. It is safe to say that social media will continue to play an increasingly important role in both personal and business lives in the future. The future of social and community platforms is difficult to predict, but there are some guesses about what trends await us (Patel, 2019). They are described in Table 2.

Unannounced algorithm updates were the worst nightmare for users a few years ago. However, today, we face a complete change in user behaviour, consumer habits, and a new generation of social media users and spenders with specific needs. Thus,

trends are predicted for 2023 (Table 3), which are building on the past, just like social media users (Biljman, 2023).

Table 2: Trends in the field of social and community platforms of the future

Trend	Description
Removing the Like Button on Instagram	Obsessing over likes has a negative impact on mental health and can hinder the free flow of engagement. That is why Instagram will no longer allow you to see the number of likes other posts receive but likes on your posts will still be available.
Less Emphasis on "Vanity Metrics"	The loss of the "like" button on Instagram is part of a broader trend of de-emphasis on using "vanity metrics" on social media. It is time for entrepreneurs and social media influencers to start delving into useful metrics like the level and quality of user engagement.
Video Story Content Is King	Video continues to be one of the most important trends in social media. In 2020, video accounted for 82% of all Internet traffic. As social platforms look for ways to further categorise video content, entrepreneurs will increasingly focus on video as part of their targeted marketing strategies. The emphasis will be on creative, engaging storytelling that captures the user's attention in seconds.
TikTok Disrupts Social Video	The focus on video has allowed specific platforms like TikTok to thrive, becoming the leading social media disruptor among Gen Z users. TikTok increases user engagement with engaging, fresh, and fun content that is not too sales-centric. In short, TikTok is the antithesis of Instagram, avoiding the overly edited and filtered view of life that Instagram is known for.
Integrating Shopping into Social Platforms	Over the past 10 years, social and community platforms have played a significant role in expanding e-commerce, as social shopping is a large part of social media. Users expect and want access to brands and products and a seamless shopping experience through social platforms, where it is necessary to create a high level of interest through creative and engaging storytelling.
Less Public, More Private Interactions	As social media "friends" lists become more limited due to privacy concerns, more users turn to private groups and messaging apps. The latter allows for more closed groups where users feel safe sharing intimate, detailed information. Messaging apps have already replaced social media as the preferred connection tool for many users.
Influencer Marketing Goes Nano	To maximise social media reach, brands should consider the influence of micro- and even nano-influencers. While there will likely always be a market for big-name influencers, there is no need to overlook the power of micro-influencers with smaller, more defined audiences. Influencers at this level offer a higher level of personalisation and stronger audience engagement. Moreover, users are more likely to follow an influencer they feel connected to than a faceless brand.

Source: (Patel, 2019)

Table 3: Social media trends for 2023

Trend	Description
Short-form video content still dominates.	Users want more short, engaging, and entertaining video content. In 2022 (based on 528 respondents), 90% of people used mobile devices to watch videos, 96% watched an explanatory video about products or services, and 88% made purchases based on the video they watched (*Video Marketing Statistics*, 2022). Short-form information is not only inevitable, but it is the most popular form of content delivery on the Internet. When creating such content, it is, however, necessary to consider the message's value and purpose for users.

Trend	Description
YouTube is alive.	Regarding demographics, TikTok tends to appeal to a younger, more tech-savvy demographic, while YouTube appeals to all demographics, including one in three baby boomers. YouTube's advantages are the ability to plan a long-term video strategy, Google's starting point for driving traffic to a YouTube channel, and high potential for repurposing (cutting up videos into shorter segments to upload on other social media platforms).
Social commerce will continue to grow.	Social media has significantly impacted consumer shopping habits even before the COVID-19 pandemic. In 2018, 30% of consumers shopped via Pinterest, Instagram, Twitter or Snapchat (Arnold, 2018). These numbers have increased during the pandemic, and consumer expectations are constantly changing. Inflation and a potential recession, supply chain issues, awareness and ESG activism affect product and service availability, competition and value.
Content creators have the power.	Many Internet users trust and believe relatives, bloggers, vloggers or social media stars regarding the reputation of a particular brand, but much less trust the marketing propaganda of companies selling a particular product or service. Users of products and services are considered more impartial (or at least appear so) because they are not a blatant case of paid business partnerships and sponsorships.
Community over followers	The groups and communities created often influence consumers in terms of creating a particular community and building their commitment to the brand in question. Based on such communities, good word of mouth spreads, opinions are shared, and occasionally, consumers receive prize draws or discount coupons.
Narrowly targeted ads on social media.	Broad targeting is good for brand awareness, but people do not like unnecessary ads. That is why narrow targeting is so important, presenting products or services that interest the individual. The challenge is competition and market saturation with similar products, the budget of target consumers, and the economic situation.
Digital trust is declining and transforming LinkedIn.	People's digital trust that platforms will protect their data and thus provide a safe environment for Internet users to create and collaborate with content is declining (Aho Williamson, 2022). As a result, it can be assumed that LinkedIn posts have changed significantly in the last two years to personal posts without connections.
Social search engine optimisation (SEO) is not something to ignore.	TikTok and Instagram have become the new search engines for Generation Z, with around 40% of young people no longer using Google Maps or Search when looking for a place to eat lunch.
Rise of AI-generated content[3]	With the rise of social media platforms, there is a growing demand for high-quality, engaging and personalised content, often generated using AI. The latter allows companies to create content quickly and efficiently, saving time and resources. There are various AI tools available (Chat GPT[4], Synthesia[5], Lexica[6]).

Source: (Biljman, 2023)

---

[3] AI-generated content refers to content created using AI tools such as natural language processing, machine learning, and computer vision (Biljman, 2023).

[4] ChatGPT is a prototype of a conversational AI-based chatbot. It is capable of understanding natural human language and producing detailed written text (Lock, 2022).

[5] Synthesia is a video creation tool that uses AI to create personalized videos (Biljman, 2023).

[6] Lexica is a tool that offers art or images created with AI (*Lexica AI - TeamSmart AI*, n.d.).

Figure 21 shows the number of users of selected social media platforms in Europe and worldwide from 2017 to 2022. As can be seen, the leading social media platforms in Europe in 2022 were (Dixon, 2023):

1. Facebook (457 million users);
2. Instagram (281 million users);
3. and TikTok (227 million users).

Other platforms include LinkedIn, Reddit, Snapchat, and Pinterest. There is an apparent annual increase in the use of these platforms at European and global levels. Specific platforms are not as popular in Europe as in the world in general.

	EU17	WV17	EU18	W18	EU19	W19	EU20	W20	EU21	W21	EU22	W22
Pinterest	0.05	0.19	0.06	0.23	0.08	0.29	0.11	0.38	0.12	0.41	0.12	0.42
Snapchat	0.07	0.22	0.08	0.25	0.1	0.31	0.11	0.41	0.12	0.5	0.12	0.55
Reddit	0.06	0.21	0.08	0.28	0.1	0.31	0.12	0.41	0.13	0.45	0.14	0.47
LinkedIn	0.08	0.49	0.09	0.58	0.11	0.64	0.15	0.7	0.16	0.74	0.17	0.72
TikTok	0.01	0.16	0.02	0.35	0.05	0.65	0.12	1.04	0.18	1.41	0.23	1.72
Instagram	0.16	0.61	0.21	0.81	0.24	0.87	0.29	1.07	0.32	1.21	0.28	1.25
Facebook	0.32	1.58	0.34	1.8	0.36	2	0.46	2.37	0.51	2.56	0.46	2.61

Figure 21: European social media users (in billions) by platform between 2017-2022
Source: (*Social Media Advertising - Europe*, n.d.; *Social Media Advertising - Worldwide*, n.d.)

Figure 22 shows data on the number of users and time spent on social networks and the level of retail e-commerce worldwide. Based on the data on the number of users of social networks, it can be concluded that an increase of several million users can be detected every year. The country that records the most time spent on social networks is the Philippines, where users spend approximately three hours and 53 minutes online daily. Based on data on online sales, it can also be concluded that the amount of money spent is increasing drastically year on year (amounting to almost 5.7 trillion US dollars in 2022).
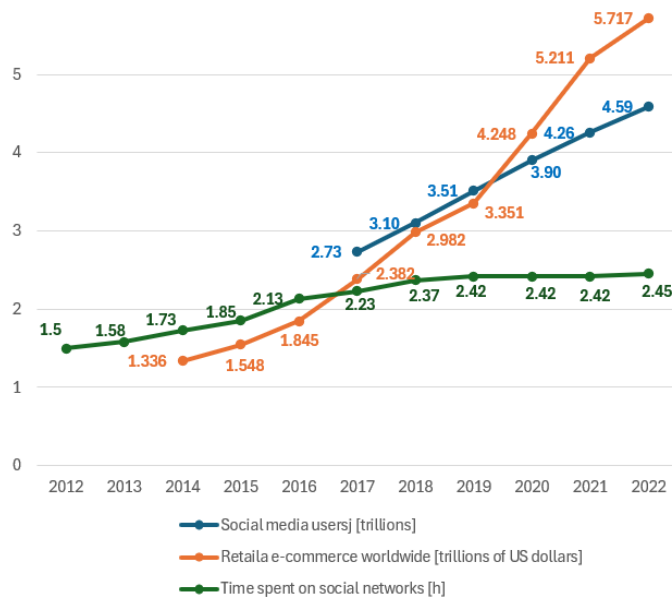
Figure 22: Number of users, level of online sales and time spent on social networks
Source: (*Global Daily Social Media Usage 2022*, n.d.; *Global Retail E-Commerce Sales 2026*, n.d.; *Number of Worldwide Social Network Users 2027*, n.d.)

In 2022, a study was conducted on the motives that encourage people to post information on social networks. Figure 23 shows all the reasons and motives among users aged between 16 and 64 and why they use and share information on social networks. The most frequently mentioned motives are (*Global Social Media Usage Reasons 2022*, n.d.):

– staying in touch with friends and family;
– filling free time;

–   reading news;

–   and searching for content (such as articles, videos, etc.).
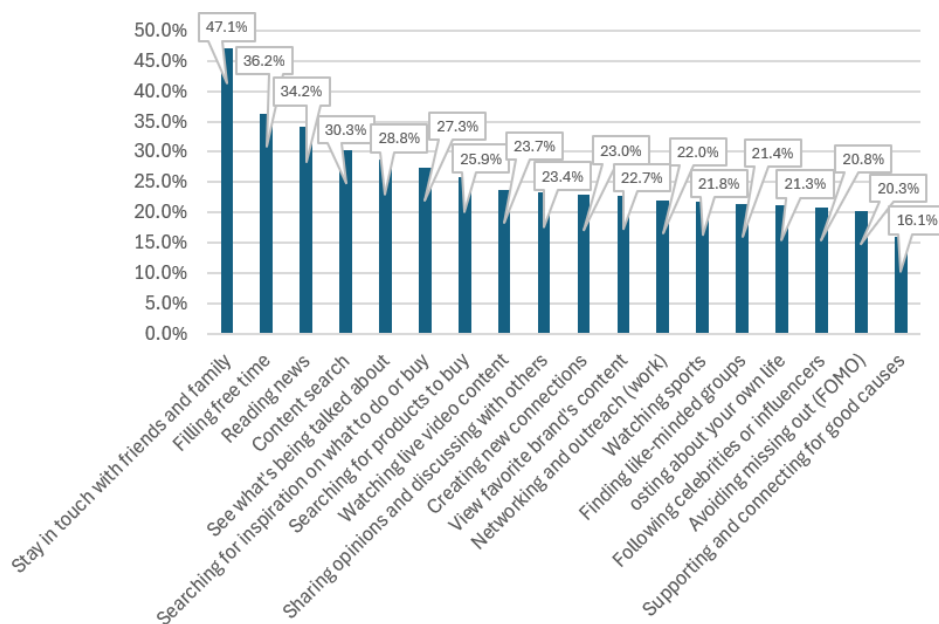
Figure 23: The most popular reasons why Internet users use social media (Q3 2022, global)
Source: (Global Daily Social Media Usage 2022, b. d.)

Figure 24 shows six questions respondents answered about the power of the Internet's influence on people. The surveyed public believes that the Internet and social media influence people. Based on the survey, the general opinion is that digital connectivity has enabled people to be more informed (73%). However, at the same time, it has also had a negative impact by facilitating the manipulation of the public (84%) (Wike et al., 2022).

The impact of simple manipulation was highlighted, as young people, in particular, are aware of the possibility of manipulation and fake news in digital media. Young people highlight digital media and social networks as key channels for receiving information about current events, for which they practically no longer use printed media. The importance and power of social networks in business, advertising, the way information is presented and created, political orientations and decisions, and the possibilities of manipulation call for better regulation, as assessing the credibility

of information and finding sources of information is sometimes tricky and should not be the exclusive responsibility of the user. Logistics companies, on the other hand, believe that communication using social networks will never become dominant in business, and business communication may change with the arrival of younger generations in leading positions.
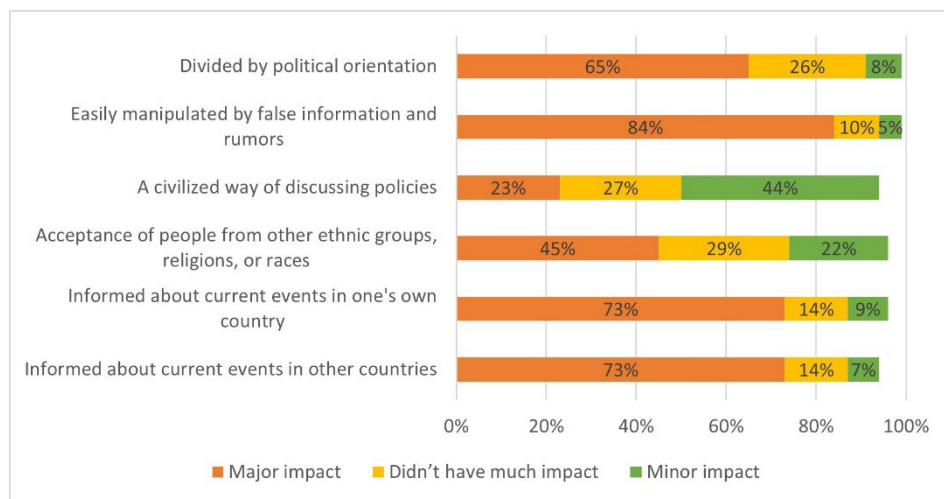
Figure 24: Impact of digital connectivity on people in percentage (19 countries included, survey conducted in spring 2022)
Source: (Wike et al., 2022)

2.3.3   Social Networks, Society and Youth

Social networks and social media can make many tasks or activities easier, as they have many advantages. The latter can be divided into general advantages for everyday use and advantages pertaining to companies. The general advantages include (Simplilearn, 2023):

– Connectivity – social media enables many users to connect anytime and anywhere, facilitating mutual interaction and sharing of information.
– Education – social media can contribute to quality education, enabling engagement on global platforms designed for collaboration, constructive learning and encouraging creativity.

- Information, news, and awareness – social media enable the sharing of information about events, activities, and happenings in other people's lives worldwide, which helps to raise awareness and general consciousness. People can also share their feelings, artwork, photos and opinions. This also brings innovation and creativity that is shared among many.

- Noble causes and community building – noble and charitable actions can be promoted through social media (collecting donations for families, patients or animals), as they provide a simple and quick way to achieve a goal. They also help build community and bring together people from different cultures, beliefs, backgrounds, or health conditions, fostering unity.

The data shows that social media has evolved from a convenient way to stay in touch with friends and family to a tool that can quickly impact society (*Global Social Media Usage Reasons 2022*, n.d.). The influence of social networks is manifested through increased interactions between people, enabling further growth and development of the social platforms in question. Thanks to the Internet, everyone can discover they are not alone, leading to the emergence of various communities The purpose of the latter is joint action in the same areas; individuals can create new content, such as posts, publications, events and online worlds, that strengthens their worldview. Without social media, social, ethical, environmental and political problems would be almost imperceptible (Simplilearn, 2023). Thus, social networks can influence and shape state policy, business operations, world culture, education, careers and innovations (*Global Social Media Usage Reasons 2022*, n.d.). The increased visibility of various issues has shifted the balance of power from the hands of a few to the hands of many. However, it is necessary to highlight a pressing issue: social media is slowly destroying real activism and replacing it with "slacktivism"[7]. While social media activism brings greater awareness of social issues, questions remain about whether this awareness is translated into real change. Some believe that sharing information on social networks has encouraged people to use computers and mobile phones to express their concerns while at the same time allowing them to not actively participate in solving the issues in question in real life. Thus, people's support is, in a way, limited to the "Like" button or content sharing. This can be described as a

---

[7] The term combines words "slacker" and "activism" and represents simple actions used to support a social cause. That is, it is an activity that uses the Internet to support political or social goals in a way that does not require much effort (e.g., signing online petitions or copying social media statuses) ('Slacktivism', 2023).

passive human reaction – an option that appears to absolve the individual of responsibility for action (Simplilearn, 2023).

Among other things, we can also see various challenges related to social networks. It is difficult to know for sure what changes and consequences will occur due to social media in the long term, but based on numerous studies, we can conclude that excessive use of social platforms has a negative impact on people (increased risk of depression, self-harm, anxiety and loneliness). One of the effects of social networks is encouraging people to form and nurture "social media friendships" instead of genuine friendships. The term "friend", as used on social platforms, is a weak shadow of traditional friendship (Simplilearn, 2023).

The term "fear of missing out" (FOMO) has also emerged among younger generations as a result of prolonged use of various online platforms and an addiction to checking what other people are doing. FOMO is an aggravated feeling that other people are living better lives or having more fun than someone else. Because of this feeling, many individuals check other people's notifications and posts almost every second to make themselves feel better. The latter ultimately leads to a lack of privacy, possible stalking and bullying, personal attacks, misuse of information and identity theft. Unfortunately, the users are often to blame for such events, as they share content that should not be in the public eye. Adolescents tend to seek desirability and compete with each other through various posts, to outdo each other. Of course, this was already happening before the advent of social platforms, but now, such behaviour is more difficult to control. In 2019, a survey of American high school students found that more than 36% of students had been a victim of cyberbullying in their lifetime, 30% had been a victim two or more times, almost 15% admitted to cyberbullying others at least once, and almost 11% had done so two or more times. Younger generations may misuse social media to spread rumours and share images and videos aimed at destroying reputations, intimidating, and ultimately blackmailing others (Simplilearn, 2023).

Other adverse consequences of social and community platforms include (Simplilearn, 2023):

–   impeding social-emotional connections by reducing expression to verbal or
     visual forms;

- impact on mental health due to lack of physical contact;
- limiting empathy, understanding and thoughtfulness and causing emotional distress;
- disturbances in focus and mind;
- lack of quality time with family and friends;
- cheating and relationship problems;
- supporting and promoting laziness;
- intrusion and sharing of sensitive information;
- and addiction.

In a 2022 survey of US teens (aged between 13 and 17), in response to the question about the overall impact of social media on them, more teens said the impact was mostly positive (32%), while only a few (9%) said the impact was mostly negative (9%). The largest share described the impact as neutral (59%). Among teens who think the impact of social media is positive, many cite maintaining friendships, making connections, or accessing information as the main reasons. While teens describe the benefits they get from social media, this positivity is not uniform. Many teens (38%) feel overwhelmed by all the drama that permeates social media. Some teens feel like they are being left out of the action by their friends (31%) or feel pressured to post content to get a lot of likes or comments (29%). These platforms make teens feel worse about their lives (23%). Half of the girls (aged between 15 and 17) often decide not to post something on social media because they are worried about the posts being used for bullying or defamation. Young people also point out that they often see the negative impact of social media on others rather than on themselves. Interestingly, only a minority of teenagers in this study describe their parents as very concerned about their use of the sites - 41% of parents are a little or not at all concerned about their use of social media, 27% are somewhat concerned, 22% are highly concerned, and 9% did not provide an answer (Anderson et al., 2022).

A slightly older study (2018) showed what young people generally like to post on social and community platforms and how often they do so (Figure 25) (Anderson & Jiang, 2018).

About 45% of teens often or sometimes post selfies on social media, with 16% saying they do so often. Similar proportions of teens sometimes post things that only their closest friends would understand (50%), updates about where they are or what

they are doing (42%), and videos they create or record themselves (41%). A smaller proportion of teens report regularly posting things they want to go viral (29%). Nearly half or more of teens rarely or never share these types of posts on social media (Anderson & Jiang, 2018).
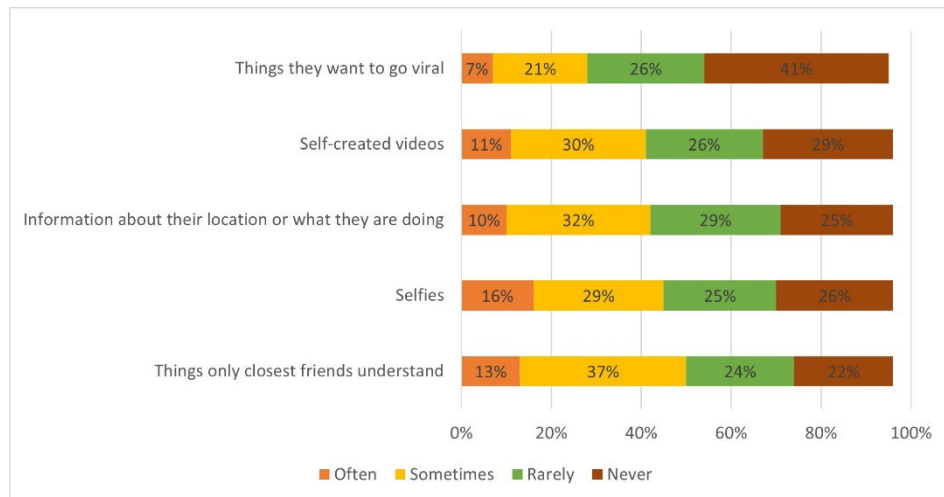
Figure 25: Percentage of US teenagers and their posts on social media
Source: (Anderson & Jiang, 2018)

Social media influences pre-teen and teenage behaviour in a variety of ways. For example, media influence can be deliberate and direct, as seen in advertising for brands aimed at children (toy advertising). Media influence can also be indirect, such as sexualised images and content, violent imagery, and coarse language in posts, documentaries, video games, and some song lyrics available on Instagram, Snapchat, TikTok, and YouTube. This media influence can suggest to pre-teens and teenagers that specific ways of behaving and appearance are "normal". Despite this, pre-teens and teenagers can still be savvy users of media platforms, as they do not necessarily believe everything they see, hear or read on social media. Therefore, if media influence is known or understood, the pressure on young people is easier to control. However, we should not ignore the benefits that young people can receive from using social media (*Media Influence on Pre-Teens and Teenagers*, n.d.):

– Young people are more likely to be interested in important social and political issues (climate change, etc.), whereby the media can encourage them to get involved in their communities.

- Health promotion though social and other media can include messages aimed at preventing depression and suicide in adolescents, promoting positive, respectful relationships, or encouraging healthy eating and lifestyle habits.
- Quality stories in television shows and films can help young people explore aspects of identity such as sexuality, relationships, gender, or ethics (for example, the treatment of gender identity in the film Bohemian Rhapsody or gender in the film Ride Like a Girl and ethics in the television show The Good Place).

Of course, there are also disadvantages (*Media Influence on Pre-Teens and Teenagers*, n.d.):

- The influence of media on young people's self-image can be inappropriate or unhealthy when they are overexposed to staged and filtered images on social media (unrealistically thin or muscular bodies), which can also have a long-term effect on body image and eating behaviour.
- Social media can influence young people's decisions about their health and lifestyle in a negative way, where eating unhealthy food, smoking, drinking alcohol and taking drugs are portrayed as "normal, responsible and cool".
- Fake news or deepfakes can influence young people to believe false information about politicians, public figures or celebrities. In some cases, hate speech and the promotion of bias against certain groups of people can also be spread in this way.

The advantages and disadvantages often depend on the young people and their perception of the content they see, hear or read. Celebrities and influencers can strongly influence young people because they are attracted to their lifestyle, product or behaviour that they promote on social media. The latter can have a negative impact (e.g., the controversial behaviour of YouTuber Logan Paul). However, there are many celebrities whose lifestyle, values and behaviour set a positive example (e.g., YouTuber Elise Ecklund). Of course, it is important to be aware that influencers and some celebrities are paid to advertise the products they represent, so their opinions can sometimes be biased. We can help young people manage the influence of the media by talking about media messages and publications, encouraging them to ask questions, understanding the process, method and purpose of advertising,

participating in online forums and/or conducting research, and balancing the influence of social media with real life (*Media Influence on Pre-Teens and Teenagers*, n.d.).

In today's rapidly evolving technological landscape, young people have a unique opportunity to harness the enormous potential of AI in innovative ways. The possibilities offered by AI are as diverse as they are transformative, ranging from personalised learning experiences to innovative problem-solving solutions. As digital natives, young individuals have a unique advantage in understanding and integrating AI tools into their studies. Implementations of AI in education include intelligent tutoring systems that adapt to individual learning styles, automated assessment systems that provide timely feedback, and virtual reality simulations that enhance hands-on learning. This integration empowers students to explore subjects in greater depth. It equips them with valuable skills such as critical thinking, data analysis, and collaboration, essential in an AI-driven world. While the impact of AI on education is undoubtedly significant, it also raises debates about ethical considerations, data privacy, and the potential for job loss. Integrating AI early on enables young people to shape these technologies ethically and responsibly, ensuring a future in which AI enhances human potential rather than replacing it (*ChatGPT*, 2023).

In addition to its profound impact on education, artificial intelligence (AI) integration reshapes the modern workplace. Young individuals entering the workforce encounter AI-powered tools that streamline processes, improve decision-making, and unlock previously unseen insights from vast data sets. From automating routine tasks to enabling predictive analytics for business strategies, the impact of AI is evident across all industries. Mastering AI tools is a strategic advantage for young professionals, empowering them to collaborate with AI systems and effectively leverage their analytical capabilities to solve complex challenges. The collaborative approach between humans and AI fuels innovation, enabling companies to explore uncharted territory and tackle complex problems. However, integrating AI also brings ethical and social considerations, such as job loss and algorithmic bias. Young people are uniquely positioned to grapple with these complexities and ensure that AI is used responsibly, inclusively, and for the benefit of society. By understanding the potential and limitations of AI, the younger generation can actively shape the role of AI in the workplace, protecting jobs, diversity, and fair practices while pushing the boundaries of what is achievable (*ChatGPT*, 2023). Undoubtedly, AI will also help find solutions for more optimal

supply chain operations, logistics simulations, big data processing, and the automation of generic tasks.

2.4   Competence Reference Framework for Sustainability and Digital Competences

The growing awareness of pressing socio-ecological issues and the need to raise awareness of society about measures for a sustainable future has encouraged many decision-makers to prepare reference frameworks for sustainability competences. The key role of the latter is to provide the basis for lifelong learning for sustainability, which will help us understand the ecological crisis, take appropriate action in response to it and solve it together (Bianchi et al., 2022). To promote lifelong learning for sustainability at the European level, the European Commission has prepared a reference framework for sustainability competences, the so-called GreenComp (January 2022). At the global level, UNESCO has developed eight key competencies for sustainability (Carretero et al., 2017). In 2010, the UN published a framework of general and leadership competencies for work within the UN (United Nations, 2010).

The latter framework considers competencies primarily from the perspective of their importance for organisational culture and the environment as two key factors for the success of employees and, consequently, the organisation (United Nations, 2010). Due to their general orientation, these competencies are primarily integrated into the UNESCO Sustainability Competencies and the European Reference Framework for Sustainability Competences, the so-called GreenComp. We observe that, in light of new insights into the seriousness of the climate change issue, better environmental awareness in society, and limited resources, sustainability challenges are not being adequately addressed and are not systematically encouraged in the education sector. However, addressing sustainability challenges is becoming a priority for both global supply chains and business logistics, as well as one of the key economic trends.

As modern society and global supply chains are becoming increasingly dependent on digital technologies due to rapid technological change, accelerated digitalisation and globalisation, digital competencies have increasingly come to the fore in recent years. The latter are considered either as an independent set of competencies or within a broader framework of competencies for a selected field. With the rapid

digitalisation of processes in both the public and private sectors, digital competencies are also becoming essential. Integrating digital technologies and competencies is also important because of their role in teaching and sustainable living, working or behaving. An example of the importance of digital technologies and competencies in sustainability is their growing role in collective action and active citizenship, for which digital platforms are often used. The latter allows participants to make joint decisions, take collaborative action and co-create solutions (Bianchi et al., 2022). Due to the growing awareness of the importance of digital competencies in sustainability, we will also include the Digital Competence Framework for Citizens - Dig.Comp 2.1 (Carretero et al., 2017).

2.4.1   Education for Sustainable Development (ESD)

The field of education for sustainable development (hereinafter referred to as ESD) has developed out of the need to address the growing sustainability challenges in education. These do not keep pace with the real sector and the challenges perceived in industries and supply chains. ESD uses activity-oriented, innovative pedagogical approaches that enable learners to acquire knowledge, become more aware, and actively contribute to transitioning to a more sustainable society.

The UNESCO Executive Board adopted the new ESD for 2030 Implementation Framework at the 40th session of the UNESCO General Conference. The ESD for 2030 builds on the Global Programme of Action (GAP), which aims to reorient and strengthen education and learning, thereby contributing to all activities that promote sustainable development. The latter is also one of the foundations of sustainable supply, as global supply chains cover all life cycle stages, from the extraction of raw materials to the management of waste after use (beyond end-of-life). It emphasises the central role of education in achieving the Sustainable Development Goals (SDGs). The Implementation Framework aims for quality and inclusive education, as well as pursuing other Sustainable Development Goals, and places responsibility for the future at its core.

2.4.2   GreenComp

As mentioned above, due to the growing need to improve and develop "knowledge, skills and attitudes for sustainable living, working and behaving", the European Commission has developed the European Reference Framework for Competences

for Sustainability, the so-called GreenComp. The initiative to develop the GreenComp framework was proposed within the framework of the European Green Deal (2019). The framework itself is based on the method used by the Joint Research Centre of the European Commission (JCR) "in the development of the Digital Competence Framework for Citizens (DigComp), the Entrepreneurship Competence Framework (EntreComp) and the European Framework for Personal, Social and Learning Key Competencies (LifeComp)". Experts in education for sustainability and lifelong learning, youth representatives, educators and policy representatives from EU Member States and non-governmental organisations (NGOs) participated in the development. The beginnings of the framework date back to the second half of 2020, when assessment studies were carried out, based on which the participants developed four areas of competence and their components (Figure 26). Experts and stakeholders subsequently revised and consolidated the proposals for the competence framework, and the final version was published in January 2022. While the first drafts of the framework focused on higher education, the final version is intended for all age groups, from children to adults. In order to capture the multidimensionality of the concept, experts suggested the word sustainability instead of the term "environmental sustainability". Since the framework had not yet been tested in a real environment at its publication, the drafters propose that it should serve as a living document, which can be improved through practical use and feedback. As recommended by the European Commission, the GreenComp reference framework can be used for various purposes, such as reviewing curricula, designing teacher education programmes, (self)assessment/reflection, policy development, certification, etc.
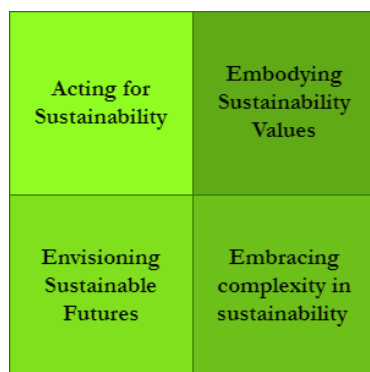
Figure 26: Four areas of the GreenComp competence model
Source: Own work.

The primary purpose of the GreenComp framework is to define competences in the field of sustainability and to support all educators and learners in integrating sustainability topics into all education and training systems and curricula in the EU Member States. The framework states that "learning for environmental sustainability is essential for achieving a sustainable mindset and fostering a willingness to take action for a sustainable future". Although learning about sustainability is crucial for ensuring a more sustainable future, it is important to be aware that this is only part of a systemic change towards sustainability, which also requires other measures such as: "investment in research and innovation, laws and regulations, transparency and accountability of companies and global value chains".

While there are many definitions for the concept, the authors of the GreenComp report provide the following definition of sustainability: "Sustainability means prioritising the needs of all life forms and the planet by ensuring that human activity does not exceed planetary limits".

The framework also provides a concise definition of sustainability competence. Sustainability competence empowers learners to embody sustainability values and embrace complex systems so that they can take action to restore and maintain ecosystem health and enhance equity. They can then demand action that creates visions for a sustainable future.

Learning about environmental sustainability is defined as follows: The purpose of learning about environmental sustainability is to cultivate a sustainable mindset from childhood to adulthood, with the understanding that humanity is part of and, therefore, dependent on nature. Learners are equipped with the knowledge, skills and attitudes to become agents of change and individually and collectively contribute to shaping the future within the planet's limits.

In order for learning for environmental sustainability to lead to more sustainable behaviour and engagement of learners, it is desirable that it be based on the principles of **transformative learning**. The latter is characterised by the fact that "learners are encouraged to reflect on and question the acquisition of knowledge, assimilate it and apply it in practice. Thus, learning involves the cognitive (head), psychomotor (hands) and emotional (heart) domains and encourages reflection, doubt and action".

The GreenComp framework identifies 12 competences for developing knowledge, skills and attitudes for environmental sustainability, which are grouped into four interrelated competence areas. For each competence, the framework provides a more detailed description of the main aspects (Table 4).

Table 4: GreenComp Framework Areas, Competences and Descriptions

Area	Competence	Description
1. Embodying sustainability values	1.1 Valuing sustainability	Reflect on personal values, define and explain how values vary between people and over time, and critically assess how they align with the values of sustainability.
	1.2 Supporting fairness	Support equity and justice for current and future generations and learn from previous generations to restore and revitalise healthy and resilient ecosystems.
	1.3 Promoting nature	Recognise that humanity is part of nature and respect the needs and rights of other species and nature itself to restore and revitalise healthy and resilient ecosystems.
2. Embracing complexity in sustainability	2.1 Systems thinking	Approach sustainability problems from all perspectives, considering time, space and context to understand the interaction of elements within and between systems.
	2.2 Critical thinking	Evaluate information and arguments, identify assumptions, challenge the status quo, and consider how personal, social and cultural circumstances influence thinking and reasoning.
	2.3 Problem framing	Frame current or future challenges as sustainability problems in terms of difficulty, actors, time and geographical scope to identify appropriate approaches to anticipating and preventing problems and mitigating and adapting to existing problems.
3. Envisioning sustainable futures	3.1 Futures literacy	Imagine alternative sustainable futures by imagining and designing alternative scenarios and identifying the actions needed to achieve the desired sustainable future.
	3.2 Adaptability	Manage transitions and challenges in complex sustainability contexts and make future-related decisions in uncertain times, ambiguity and risk.
	3.3 Exploratory thinking	Adopt relational thinking based on studying and integrating different fields using creativity and experimentation with new ideas or methods.
4. Acting for sustainability	4.1 Political agency	For navigating the political system, identify political responsibility and accountability for unsustainable behaviour, and demand effective policies for sustainability.
	4.2 Collective action	Take action for change in collaboration with others.
	4.3 Individual initiative	Identify one's potential for sustainability and actively contribute to improving the prospects for the community and the planet.

Source: (Bianchi et al., 2022)

The framework then defines all 12 competences in more detail and provides examples of knowledge (K), skills (S) and attitudes (A) for each. In addition, two examples of the implementation of the reference framework and the 12

competences for sustainability addressing concrete challenges are provided, as well as an extended reference model of competences for sustainability, in which statements for knowledge, skills and attitudes are added for each competence and description to define individual competences in more detail.

2.4.3   UNESCO's Competency Framework

The UNESCO Competency Framework for Sustainability is published in the UNESCO report »Education for Sustainable Development Goals: Learning Objectives« (UNESCO, 2017). As stated in the latter, UNESCO (United Nations Educational, Scientific and Cultural Organisation), as a specialised agency of the UN, has taken on the task of leading and coordinating the Education 2030 Agenda. The aforementioned agenda is part of the global effort to eradicate poverty through the 17 Sustainable Development Goals, which we presented in the first chapter (UNESCO, 2017). The central focus of Goal 4 is quality education. Due to its role and importance, ensuring quality education is not only one of the goals for achieving sustainable development but also a key element for achieving the remaining 16 goals and, thus, sustainable development itself.

Within the framework of Goal 4 on education, the report defines the concept of education for sustainable development and its importance in achieving the remaining 16 Sustainable Development Goals (UNESCO, 2017). The report defines eight key competencies for sustainability as the general goal of education for sustainable development, which are cross-cutting and relevant to all 17 Sustainable Development Goals (Table 5). UNESCO's competencies represent the key sustainability competencies that sustainable citizens need to address increasingly pressing and complex challenges. These competencies are linked to all Sustainable Development Goals and enable individuals to connect individual goals, which is crucial for understanding the "big picture" of the 2030 Agenda for Sustainable Development. It is also important to emphasise that UNESCO's competencies apply to learners of all ages worldwide.

The publication then defines learning objectives and provides recommendations for content and learning activities for individual sustainable development goals. The report also provides examples and recommendations for implementing learning for sustainable development at various levels, from preparing or planning curricula/subjects to formulating national strategies.

Table 5: UNESCO's Key Competencies for Sustainability

Competency	Ability description
Systems thinking competency	The ability to recognise and understand relationships, analyse complex systems, consider how systems are integrated across different domains and scales, and deal with uncertainty.
Anticipatory competency	The ability to understand and evaluate different futures – possible, probable, and desirable – to create one's vision of the future, apply the precautionary principle, assess the consequences of actions, and deal with risks and changes.
Normative competency	The ability to understand and reflect on the norms and values on which one's actions are based, to negotiate sustainable values, principles and goals in the face of conflicts of interest and compromises, uncertain knowledge and contradictions.
Strategic competency	The ability to collectively develop and implement innovative actions that promote sustainability at the local level and beyond.
Collaborative competency	The ability to learn from others, to understand and respect the needs, views and actions of others (empathy), to understand, connect and be sensitive to others (empathic behaviour), to deal with conflicts in a group and to promote collaborative and participatory problem-solving.
Critical thinking competency	The ability to question norms, practices and opinions, reflect on one's values, perceptions and actions, and take positions in discussions on sustainability.
Self-awareness competency	The ability to reflect on one's role in the local community and (global) society, to continuously evaluate and further motivate one's actions, and to deal with one's emotions and desires.
Integrated problem-solving competency	The ability to use different problem-solving models to address complex sustainability issues and develop feasible, inclusive and equitable solutions that promote sustainable development. This ability includes all the above-mentioned competencies.

Source: (UNESCO, 2017)

The report pays special attention to integrating education for sustainable development into teacher education and implementing it at educational institutions. It provides key elements, examples, pedagogical approaches, teaching methods, and examples of evaluating the achievement of set goals.

2.4.4   United Nations Competency Framework

The origins of the UN competency model date back to 2002, when the Secretary-General of the United Nations initiated a project focused on strengthening human resource capacity by implementing core values and generic competencies for all employees. Leadership competencies later supplemented these generic competencies (United Nations, 2010). The UN's generic and leadership competencies thus provide the foundation for human resource management in the UN and beyond within any organisation or company.

According to the UN definition, competency is a combination of skills, characteristics and behaviours directly related to the successful performance of a job. General competencies are those skills, knowledge and behaviours important for all employees, regardless of their function or position. In contrast, managerial competencies are skills, knowledge, and behaviours crucial for managers (United Nations, 2010). An important aspect of the definition of competencies, given in the report »United Nations Competencies for the Future« (United Nations, 2011), is their future orientation, whereby competencies include the skills and characteristics that staff and managers need in developing a new organisational culture and in facing new challenges. One of the emerging challenges is undoubtedly environmental and sustainability issues, in solving of which both general and managerial competencies defined in the United Nations document are indispensable. Due to their general orientation and key importance for functioning in the business environment and beyond, the UN competencies (Table 6) largely overlap with the European Competence Reference Framework for Sustainability (GreenComp) and UNESCO's Key Competencies for Sustainability.

Table 6: UN competencies

General competencies	
Communication	– Speaks and writes clearly and effectively. – Listens to interlocutors, interprets the messages of others appropriately, and responds appropriately. – Asks questions for clarification and shows interest in two-way communication. – Adapts language, tone, style, and communication format to the audience. – Demonstrates openness in sharing information and informing people.
Teamwork	– Collaborates with colleagues to achieve organisational goals. – Acquires and values the ideas and expertise of others and is willing to learn from others. – Places team agenda above personal agenda – Builds consensus to achieve goals and coordinates them with group members. – Supports and acts by the group's final decision, even when the joint decisions do not fully align with his/her personal views. – Shares credit for team achievements and accepts joint responsibility for team failures.
Planning and organising	– Develops clear goals that are consistent with agreed strategies. – Identifies priority activities and tasks and adjusts priorities to needs. – Appropriately allocates time and resources to carry out work.

General competencies	
	– Anticipates risks and unforeseen circumstances when planning. – Monitors and adjusts plans and actions as necessary. – Uses time effectively.
Accountability	– Takes responsibility and honours obligations. – Completes tasks for which he/she is responsible within the prescribed time, cost and quality standards. – Acts by the rules and regulations of the organisation. – Supports subordinates, reviews and takes responsibility for assigned tasks. – Takes personal responsibility for his/her shortcomings and the shortcomings of others in the work unit when necessary.
Client orientation	– Treats all those to whom he/she provides services as "customers" and tries to view things from their perspective. – Creates and maintains productive customer partnerships with customers by gaining their trust and respect. – Identifies customer needs and matches them with appropriate solutions. – Monitors the flow of events within and outside the customer environment for ongoing insight and anticipation of problems. – Informs the customer about progress and setbacks in the project. – Provides products or services to the customer within the agreed-upon timeframe.
Creativity	– Seeks opportunities to improve programmes and services. – Offers new and different ways to solve problems and meet customer needs. – Promotes new ideas and persuades others to consider them. – Takes calculated risks for new and unusual ideas and thinks outside the box. – Is interested in new ideas and new ways of doing things. – Is not limited by current thinking and traditional approaches.
Technological awareness	– Keeps up to date with available technologies. – Understands the usefulness and limitations of technology in office work. – Strives to actively incorporate technology in performing relevant tasks. – Demonstrates willingness to adopt new technologies.
Commitment to continuous learning	– Keeps up to date with developments in his/her professional/professional field. – Commits to professional and personal development. – Contributes to the learning of colleagues and subordinates. – Demonstrates willingness to learn from others. – Seeks feedback for learning and improvement.

Source: (United Nations, 2011)

Leadership competencies	
Vision	– Identifies key issues, opportunities, and risks. – Clearly defines the connection between the organisation's strategy and work unit objectives. – Creates and communicates a broad and compelling organisational direction and inspires others to follow the same direction. – Expresses enthusiasm for future opportunities.
Leadership	– Serves as a role model that others want to follow. – Empowers others to translate vision into results. – Is proactive in developing strategies to achieve goals. – Builds and creates relationships with a wide range of people to understand needs and gain support. – Anticipates and resolves conflicts by seeking mutually acceptable solutions. – Strives for change and improvement, does not accept the "status quo". – Demonstrates courage to embrace unpopular viewpoints.
Empowering others	– Delegates responsibility, clarifies expectations and gives employees autonomy in important work areas. – Encourages others to set challenging goals. – Holds others accountable for achieving goals related to their area of responsibility. – Values the contributions and expertise of all employees. – Shows gratitude and rewards achievements and effort. – Involves others when making decisions that affect them.
Managing performance	– Delegates appropriate responsibilities, accountability and decision-making authority. – Ensures that roles, responsibilities and reporting lines are clear to all employees. – Appropriately assesses the time and resources required to complete a task and aligns the task with skills. – Monitors progress against milestones and deadlines. – Regularly reviews performance and provides feedback and guidance to staff. – Encourages accountability and supports staff when/if they make mistakes. – Actively supports the development and career aspirations of employees. – Evaluate performance fairly.
Building trust	– Provides an environment where others can speak and act without fear of consequence. – Leads prudently and predictably. – Operates transparently, without ulterior motives. – Trusts colleagues, staff and customers. – Appropriately recognises the merits of others. – Acts by agreed-upon activities. – Appropriately handles sensitive and confidential information.
Judgment/Decision making	– Recognises key elements of complex situations and quickly identifies the core of the problem.

Leadership competencies
– Obtains all relevant information before making decisions.
– Considers positive and negative effects on others and the organisation.
– Proposes a course of action or makes a recommendation based on all available information.
– Checks assumptions against facts.
– Ensures that proposed actions will satisfy the expressed and fundamental needs for the decision.
– Makes difficult decisions when necessary.

Source: (United Nations, 2011)

The document »UN Competency Development – A Practical Guide « (2010) further defines values and general leadership skills, first for staff members, then for leaders and leaders of leaders. For all three categories (staff members, leaders, leaders of leaders), behaviours are rated from unsatisfactory, require development, fully competent, and outstanding. Activities for developing values and competencies are also given.

2.4.5   DigComp 2.1: Digital Competence Framework for Citizens

The origins of the European Digital Competence Framework for Citizens date back to 2015, when the Joint Research Centre (JRC) launched the Learning and Skills for the Digital Age Research Project. The research aimed to provide the European Commission and EU Member States with evidence-based support for policy-making on the use of digital technologies in education and training, the integration of digital technologies into lifelong learning, and the identification of digital skills and competences needed for employment, personal development and social security (adapted from Carreto et al., 2017.

To improve the digital competences of the EU citizens, the Joint Research Centre (JRC) has developed the European Digital Competence Framework for Citizens, known as DigComp. The latter was conceived as a multi-stakeholder project. The first digital competence framework, DigComp, was published in 2013. The first update, DigComp 2.0, was published in 2016. The third update, DigComp 2.1, was published in 2017 (adapted from Carretoet al., 2017.

The SRS has prepared the following frameworks for the field of digital transformation of education and learning and related skills and competences: DigCompEdu (digital competence framework for educators), DigCompOrg (digital competence framework for educational institutions), DigCompConsumers (digital competence framework for users), OpenEdu (framework for greater openness of higher education institutions), and EntreComp (competence framework for entrepreneurship) (Carretero et al., 2017).

The DigComp framework encompasses five dimensions (Carretero et al., 2017):

DIMENSION 1: areas that have been identified for each digital competence;
DIMENSION 2: competences related to a specific area;
DIMENSION 3: levels of competence achievement;
DIMENSION 4: examples of knowledge, skills and attitudes for a specific competence;
DIMENSION 5: examples of use and applicability of competences for different purposes.

DigComp 2.0 (2016) and DigComp 2.1 (2017) define the areas of competence and the competences themselves, both of which are presented in Table 7.

DigComp 2.1 includes the following eight levels of competence achievement (Carretero et al., 2017):

- – helplessness levels: 1 and 2;
- – survival levels: 3 and 4;
- – obstacle overcoming levels: 5 and 6;
- – mastery levels: 7 and 8.

In the following, DigCOmp 2.1 - Digital Competence Framework for Citizens (2017) provides a table of competences by area, with all eight levels of competence achievement included for each competence, along with detailed descriptions and examples of use for the selected levels.

Table 7: DigComp 2.0

Areas of competence	Competencies
1. Information Literacy	1.1 Browsing, searching and collecting data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
2. Communication and Collaboration	2.1 Communicating through digital technologies 2.2 Sharing content through digital technologies 2.3 Active Citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Digital identity management
3. Digital Content Creation	3.1 Digital content development 3.2 Digital content deployment and reproduction 3.3 Copyright and licenses 3.4 Programming
4. Safety	4.1 Device safety 4.2 Personal data and privacy protection 4.3 Health and wellbeing protection 4.4 Environmental protection
5. Problem Solving	5.1 Solving technical problems 5.2 Identifying needs and technological bottlenecks 5.3 Creative use of digital technologies 5.4 Identifying digital divides

Source: (Carretero et al., 2017)

2.5 Lifelong Learning (LLL) to Support Digitalisation and Sustainable Development Goals

Lifelong learning can be defined as the continuous, self-motivated pursuit of knowledge for personal and professional development. It is not limited to formal education but encompasses learning experiences in various settings, from structured classroom processes to independent study and experiential learning in everyday life. In its Communication on Lifelong Learning (Commission of the European Communities, 2001), the EU emphasises that, in addition to focusing on learning from pre-school to retirement, lifelong learning encompasses formal, non-formal and informal learning methods and environments. Its objectives include active citizenship, personal fulfilment, social inclusion and skills acquisition for better/easier employment. The principles emphasise the importance of the learner, equal opportunities and the quality of learning opportunities.

In a modern society, where rapid technological progress is constantly reshaping our knowledge and tools, the importance of lifelong learning is brought to the forefront.

Its key role is seen in ensuring the adaptability and resilience of the individual in response to rapid social and technological changes. Without continuous education and learning, there is a risk of stagnation and obsolescence of competences. Through lifelong learning, we acquire professional skills, promote personal growth, broaden career horizons and strengthen the sense of purpose and fulfilment (Field, 2006).

As digital technologies evolve, the demand for digital literacy is increasing. Whether it is understanding the basics of online communication or delving into artificial intelligence, continuous learning is crucial and represents an important segment. Digital technologies are transforming economies and other sectors and redefining work roles. Therefore, according to the World Economic Forum (World Economic Forum, 2016), involving stakeholders in lifelong learning ensures that individuals and organisations are well-equipped to navigate digital transformation. This also plays a key role in the transition to a sustainable future, as education for sustainability must be lifelong and emphasise the acquisition of relevant values and patterns, not just knowledge (UNESCO, 2014). It equips individuals with the knowledge and skills needed to address complex challenges such as climate change, biodiversity loss, and social inequality. In addition, lifelong learning fosters a mindset of adaptability and innovation, which are essential for designing sustainable solutions.

Engaging in lifelong learning initiatives offers countless benefits to individuals, businesses and society. Some of the benefits are:

- Personal and professional development. Engaging in lifelong learning can improve competences, skills and abilities, making participants more competitive in the labour market and promoting personal growth (Ting et al., 2015).
- Improved professional status. In addition to improving competences, lifelong learners can also improve their actual job position, which is frequently followed by increased pay for their work (Dorsett et al., 2010).
- Adaptability in a changing world. Such activities help individuals keep up with rapid technological and social changes, ensuring they remain relevant in their professions and informed as citizens. They adapt quickly to environmental changes (Jandrić & Ranđelović, 2018).

- Cognitive benefits. Engaging in lifelong learning is associated with health benefits, especially regarding cognitive abilities, which can slow cognitive decline in older adults (Simone & Scuilli, 2006).
- Social and psychological benefits. Involvement in lifelong learning provides opportunities for social interaction, reduces feelings of isolation, fosters a sense of community, and positively impacts the psychological factors of the wellbeing of participants (Park et al., 2016).
- Wider impacts are observed because a society that promotes lifelong learning is in a better position for economic growth, as its workforce remains skilled and adaptable. Individuals are more empowered and remain, active citizens (Aleandri & Refrigeri, 2013).

2.5.1   Successful Practices of Lifelong Learning Online

Lifelong learning is greatly enhanced in today's digital age by the proliferation of online platforms and resources. Massive open online courses (MOOC), such as those offered by Coursera and edX, democratise access to high-quality education and allow individuals to engage in formal and informal learning experiences at their convenience (Hollands & Tirthali, 2014).

Key elements of MOOCs are set (loose) time frames, expected work from the participant, and instructor feedback. At the end, participants usually receive certificates of completion (Petronzi & Hadi, 2016). A typical MOOC format is designed so that upon registration, the user receives access to the materials and assignments and a planned schedule of activities within the course and then processes the material at their own pace, prepares solutions to the problems set, or demonstrates their knowledge in some other way. During this time, they usually also participate in discussions with other participants or in peer evaluation, and a final exam or submission of a final project is often expected. Below, we will present the largest providers of MOOC courses and their main features.

Coursera is a global online education platform that offers various levels of MOOC courses in collaboration with more than 300 educational institutions (*Coursera*, n.d.). It offers various forms of free and paid education, covering various courses, specialisations, professional certificates and entire master's programmes. Its speciality is the transition from classic MOOC education towards formal forms of

education recognition, as some universities already recognise completed Coursera courses as part of mandatory study content. It also offers the so-called MasterTrack certificates, representing certification of acquired competences in a particular field. The business model is focused on free participation in courses, while advanced services or personal certifications are paid services. Currently, Coursera offers more than 12,500 courses at different levels and durations and has more than 300 partner providers (*Courses and Certifications*, n.d.).

edX is a platform fundamentally related to Coursera. It operates on the same principles as MOOC courses, which are structured in a weekly format and openly accessible, and it offers certificates at the end of the course. edX offers paid services towards certification programmes and the acquisition of formally recognised educational outcomes. Their speciality is also the so-called XSeries certificates, which combine several shorter field courses into a whole, which allows the participant to obtain a certificate of competence in a particular field. They currently offer more than 4,000 courses in cooperation with around 250 partners. (*edX Courses*, n.d.)

Udacity is a platform whose primary focus is training established professionals or employees transitioning into the work environment. In addition to standard formats for MOOC providers, they also offer the so-called Nanodegree programmes, which are aimed at offering additional training for the transition of the workforce to the labour market after completing their studies or retraining, as they are based on real projects and feedback from mentors from practice (*What Is a Nanodegree Program?*, n.d.). Udacity also offers a combination of free and paid courses and services, whereby all services that enable the formalisation of the acquired education are chargeable.

FutureLearn is a provider based in the UK, not the US. The basic concept of education is the same as that of other MOOC providers, with FutureLearn offering an annual subscription to all content and courses, allowing for unlimited certifications. Only a few of the courses offered are free. They offer four courses: short courses, courses designed to specialise in a particular field, courses designed to acquire micro-credentials, and larger sets of courses that can lead to a formally recognised qualification. They currently offer over 4,000 courses (FutureLearn, n.d.).

2.5.2   Open Educational Resources

Open Educational Resources (OER) advocates the idea of free access to educational content, making knowledge more accessible to diverse audiences worldwide (Wiley et al., 2014). These platforms are based on access to information and knowledge. However, they do not have the basic features of MOOC platforms, such as a structured environment, peer collaboration and educator feedback. They usually do not contain interactive elements and are not pre-determined into sets of materials that would form courses. The materials are generally available in flexible, accessible formats without specified time frames. Some of the most developed and used examples of OER platforms are:

−   Khan Academy - a free, non-profit online learning platform that covers a wide range of subjects from basic arithmetic and school-level knowledge to economics and computer science. It offers customised learning dashboards that allow students to learn at their own pace. The platform is mainly known for its interactive exercises and videos (*About Khan Academy*, n.d.).

−   MIT OpenCourseWare offers a wide range of free university-level content that is entirely self-paced without formal feedback or accreditation mechanisms. It is partly upgraded from the MIT Open Learning Library, which offers assessment and assignment elements but is done automatically and without pedagogical guidance (*MIT Open Learning Library*, n.d.).

−   Directory of Open Access Journals - DOAJ is a directory or collection of scientific resources and articles published in open-access journals. As such, it provides access to scientific research to a broader range of users (*About DOAJ*, n.d.).

−   OER Commons - OERC is a digital public library and collaboration platform dedicated to discovering and using open educational resources. It offers a comprehensive infrastructure for teachers, students, and individual learners to access, share, and contribute to high-quality, openly licensed educational materials for all levels of education (*OER Commons*, n.d.).

2.5.3   Courses and Seminars Organised by Higher Education Institutions

In the modern world, traditional higher education institutions are seeking to remain relevant and impart knowledge not only through traditional methods of education but also through innovative approaches (Chiţiba, 2012). Therefore, they have

started leveraging digitalisation and online teaching trends in the field of lifelong learning. They have started offering their educational content online (primarily by implementing MOOC courses) and opening up their offer to external users through seminars and lifelong learning courses.

These courses are mostly paid but offer formal recognition of completed education and assessment with ECTS credits. In modern supply chain management, we can find, for example, the specialised Kühne Logistics University, which, in addition to undergraduate and postgraduate programmes, offers the so-called "Executive education programmes" or intensive seminars that combine live and online teaching. They are intended for employees looking for opportunities to upgrade their knowledge in supply chain management, supply chain sustainability and trends (Kühne Logistics University, n.d.). A similar intensive course for managers in the field of Industry 4.0 is offered by the Wroclaw University of Economics and Business, which, in the framework of the Stanversity programme, offers online lectures from experts in the field (*Courses at Wroclaw University of Economics*, n.d.). A more classic model of lifelong learning is offered by the Finnish Tampere University, which offers a model of the so-called "Open University" and enables the inclusion of participants in the framework of lifelong learning in regular pedagogical activities at the university (the participant participates in a course that students take as part of their studies) (*Open University*, n.d.).

Higher education institutions typically employ a combination of different methods for offering lifelong learning programmes to reach the largest number of participants, increase their visibility and disseminate knowledge most effectively. An example is Chalmers University, which offers professional development and lifelong learning through special courses for famous clients, independent lifelong learning courses, inclusion of participants in regular study activities and delivery of MOOC courses through the edX platform (*Continuing Professional Development*, 2023).

2.5.4   Courses and Seminars Organised by Commercial Providers

In the context of lifelong learning, courses and seminars organised by commercial providers offer current and tailored content that reflects market needs. Compared to traditional education, they are more flexible, accessible and focused on practical skills. They often collaborate directly with the industry, which provides applicable knowledge. Their courses usually lead to recognised certificates that can improve

participants' career prospects. In the dynamic environment of commercial providers, the offer is constantly renewed and adapted to meet modern requirements and trends, making them key players in the lifelong learning process.

To successfully adapt to changes in the industry, alongside the general education providers of lifelong learning, important stakeholders such as certification bodies, standardisation, and even regulatory bodies play an important role in providing lifelong learning. An example of this is the specialised education offered by the Slovenian Institute for Quality and Metrology, especially in the areas of quality, management, standards and metrology (*Program izobraževanj SIQ*, n.d.). In the field of digitalisation, the Slovenian Informatics Society offers related courses and certification through its education, which is in line with the guidelines of the European Computer Driving License (*ECDL programi*, n.d.).

2.6   Summary of Theoretical Insights and Impact on Knowledge for the Green and Digital Transition

The field of sustainable development and digitalisation of logistics and supply chains is becoming increasingly relevant not only in the academic and political spheres, but also in business logistics, global supply chains and, last but not least, in everyday life. The new challenges of the green and digital transition raise questions and reveal the need for knowledge in the field of sustainable development and digitalisation, which in the past could not be acquired as part of formal education, as they practically did not exist yet.

These are the needs that, on the one hand, are required by changes in legislation, such as the CSRD directive or the EU taxonomy, and on the other hand, by increasing public awareness of the seriousness of the environmental crisis and the impacts of environmental degradation on our lives, businesses and wellbeing. Therefore, we are more susceptible to actual changes in patterns of thinking and action. As shown, the concepts of sustainable consumption, circular economy, more sustainable approaches, digitalisation, social media use, and artificial intelligence need greater attention in modern education for the green and digital transition to society 5.0. Most of them are new knowledge that did not exist in this form in the past and were not systematically included in formal education ten or more years ago.

The analysed reference frameworks for sustainability and digital competencies show priority knowledge and skills that will be needed to deal with the challenges of sustainable development and digitalisation successfully. They highlight the importance of collaboration, critical thinking, a systemic approach, problem-solving and the ability to foresee. To successfully and effectively integrate new knowledge into formal higher education and lifelong learning in the field of logistics and supply chains, it is first necessary to carefully examine and identify which knowledge is currently the most interesting and most needed by companies, as well as the gap between the current knowledge and knowledge that will be most relevant in five years.

Which knowledge in sustainability, digitalisation and resilience in supply chains do logistics and manufacturing companies, academics and logistics students see as priority areas that will be most relevant in the next five years? We answer this question in the next chapter, which should represent one of the frameworks for renewing and creating the future supply chain of knowledge.

3   Research Section

The research part of the monograph brings new perspectives to the field of sustainable development and digitalisation with a special emphasis on the field of logistics and supply chains. The need for new skills in the field of sustainable development and digitalisation is changing rapidly. These are the needs that, on the one hand, are required by a change in legislation, which is legally binding, and on the other hand, are related to actual changes in the behaviour patterns of stakeholders in the supply chain and the awareness that resources are limited, and anthropogenic pollution and resource exploitation are excessive. These insights are becoming crucial for both the individual and the society for a successful implementation of the green transition.

The research section is divided into three parts:

1) The first part begins with a brief description of the legislative framework and a presentation of the most important results of the "Do-no-harm" analysis for Slovenia.
2) The second part of the research work covers the results of the research, which was carried out in the territory of Slovenia, and refers to the inclusion of the contents of sustainable development and digitalisation in higher education study programmes. In a special subsection, we focus in more detail on the inclusion

of sustainable and digital content in the study programmes of the Faculty of Logistics of the University of Maribor (FLUM).

3)   The third part of the research represents the monograph's essential contribution to science. It covers the study of gaps in the sustainable, digital and transversal competencies of three target groups: the business sector in logistics and supply chains, students of logistics and the academic sector in logistics. In addition to studying the gaps between the currently needed knowledge, skills and abilities in the three identified areas and their assessed importance in 5 years, we also examined the differences in how these gaps are perceived among the three target groups.

An additional value to the research work of the monograph is provided by the results relating to the perception of an individual's sustainable lifestyle, as different perceptions of sustainability affect the development of different lifestyles, which can be more or less sustainable. Furthermore, the research part also includes results related to using various innovative pedagogical approaches in teaching. This section was carried out exclusively among the target group of students to identify the most suitable pedagogical approaches for students, i.e., stakeholders of formal and not lifelong education. They can clearly identify which approaches allow them to achieve the highest level of retention of the taught content and which teaching methods and approaches are most engaging for them.

3.1   Sustainable Development and Legislative Framework

The first part of the research highlights the legislative framework in the field of sustainable development, which, as noted, guides the operation and development of companies participating in supply chains. We identified 110 laws in Slovenian legislation that relate to the field of sustainable development. To this can be added 98 directives and regulations at the EU level that supplement or create the legislative framework in Slovenia. In addition, we identified 63 proposed changes to the legislative framework related to the field of sustainability, which indicates the complexity of legislation in the field of sustainable development. It highlights the fact that the transition to climate neutrality is supported by extensive legislation that is constantly updated. We used the Ecolex web portal to help us in the search, and we covered the legislation in force on 31 December 2022 (Figure 27) (*Zakonodaja*, n.d.).
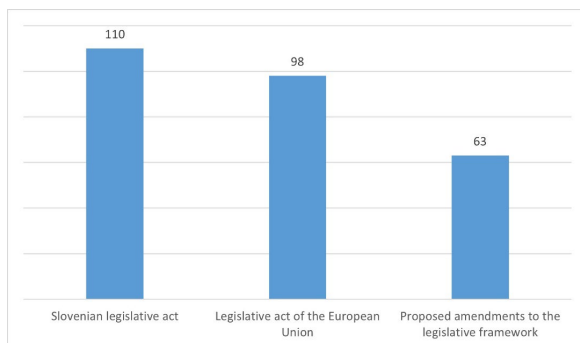
Figure 27: Display of the number of legal acts within the legislative framework and proposed amendments to legal acts
Source: Own work.

Thus, we defined the legislative framework for sustainable development in Slovenia. We then checked which economic areas individual laws relate to. We linked the legislative framework to the types of economic activities in Slovenia for which the EU taxonomy tool can be applied. There are 85 such economic activities (SiStat, n.d.-b). We found that 48.42% of the laws relate to a maximum of three economic activities, meaning that elements of sustainable development are included in regulations that define the operation of companies within a particular economic activity or a smaller group. 23.68% of the laws relate to all economic activities, and these are fundamental laws that relate to the promotion of sustainable development in Slovenia, such as Eco-Fund subsidies for the purchase of zero-emission vehicles or energy renovation of buildings (Figure 28).
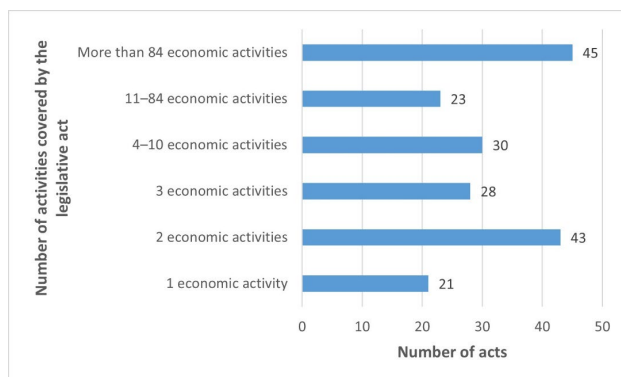
Figure 28: Linking sustainable development laws and the scope of economic activities they affect
Source: Own work.

Next, we focused on the second set of assessments according to the EU taxonomy criteria, namely the "Do-no-harm" concept. With the help of this analysis, we can classify activities that contribute to achieving a specific taxonomy objective and, at the same time, do not significantly harm its other objectives. First, all economic activities in Slovenia were included in the analysis based on the data from the Statistical Office of the Republic of Slovenia (SiStat, n.d.-b). The analysis showed that the majority of economic activities in the taxonomy objectives are categorized under the option "Do no significant harm" (hereinafter: "Do-no-harm"), and a smaller proportion under the option "Contributes". The only exception is the objective of climate change adaptation, where the majority of economic activities are those activities that significantly contribute to climate change adaptation (Figure 29).
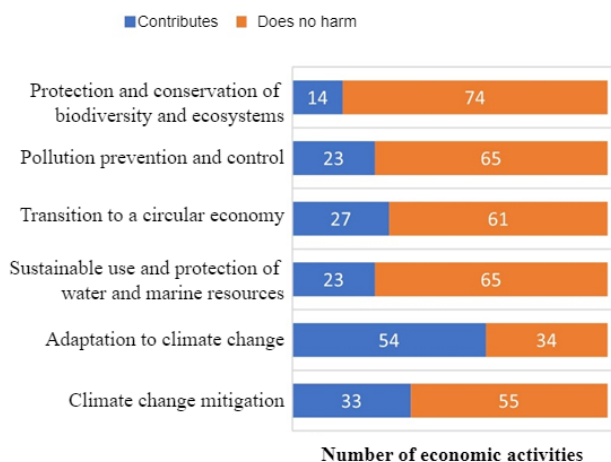
Figure 29: The "do-no-harm" analysis for Slovenia
Source: Own work.

We limited the number of economic activities based on the current taxonomy criterion for company size (*Application of the EU Taxonomy for Companies*, n.d.). Accordingly, 59 economic activities in Slovenia were included in the analysis, as there are no companies in the remaining economic activity categories that would meet the current taxonomy criterion. The analysis again showed that the majority of economic activities are categorized under the "Do-no-harm" option, with a smaller share under the "Contributes" option. The only exception was the climate change adaptation objective (Figure 30).
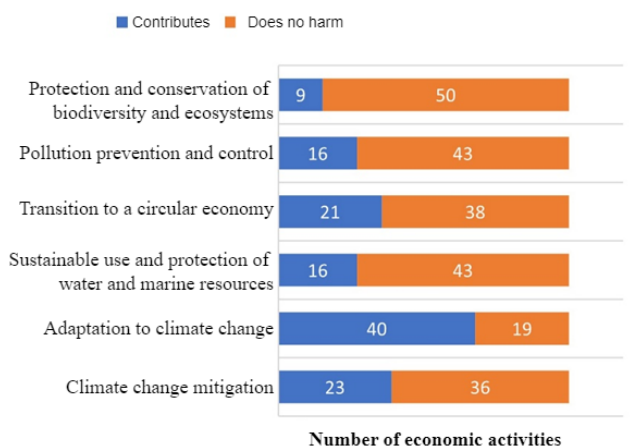
Figure 30: "Do-no-harm" analysis for Slovenia, adjusted to company sizes
Source: Own work.

We must look at the processes and environment of the company as a whole and take this fact into account when transitioning to a sustainable business model. Figure 30 and Figure 31 show that we should not ignore the "Do-no-harm" option, as most economic activities are classified under this option in the "Do-no-harm" analysis. Companies must therefore be aware of the consequences of implementing individual measures.

Given the increasing interest in knowledge in the field of sustainable operations and knowledge of the field due to the accompanying legislation both in logistics companies and companies involved in international supply chains in general, in the next step, we checked how individual areas of sustainable development are included in higher education institutions. The results are presented in subsection 3.2.

3.2 Overview of the Inclusion of Sustainable Competencies in Higher Education

In Slovenia, we have 106 higher education institutions (faculties, art academies, colleges of higher education), which together offer 1052 study programmes. The University of Maribor (17 faculties), the University of Ljubljana (27 institutions), the University of Primorska (6 faculties) and the Faculty of Information Studies are public higher education institutions and have a total of 50 faculties and academies. There are 55 private higher education institutions in Slovenia. The Slovenian

Qualifications Framework (SQF) is a unified system of qualifications in the Republic of Slovenia for classifying qualifications into levels according to learning outcomes. It consists of 10 levels, of which levels 6 to 10 are intended for the tertiary level of education (Ministrstvo za vzgojo in izobraževanje, n.d.). First-cycle study programmes are undergraduate study programmes, while second- and third-cycle study programmes are postgraduate study programmes (Zakon o Visokem Šolstvu (ZVis), 33. Člen, 1994). The first cycle includes Higher professional education (HPE) and University education (UNI). Both types of education last 3 to 4 years, and the SQF qualification level upon completion is 7. Higher professional education programmes and university education programmes comprise 180 to 240 ECTS credits. The second cycle includes Master's education (MA). Education lasts one to two years, and master's study programmes comprise 60 to 120 ECTS credits. The SQF qualification level upon completion is 8. The third cycle includes Doctoral education (DR/PhD). Education lasts 3 or 4 years, and doctoral study programmes comprise 180 to 240 ECTS credits. The SQF qualification level after completing education is 10. The Classification System of Education and Training (hereinafter: KLASIUS) is understood as a mandatory national standard used in recording, collecting, processing, analysing, transmitting and disseminating statistical and analytical data important for monitoring conditions and trends in the socio-economic and demographic field in the Republic of Slovenia (Uradni List RS, Št. 46/06 in 8/17, 1. Člen, 2006). KLASIUS is used for classifying activities and outcomes of education and training in official and other administrative data collections (records, registers, databases, etc.) and statistical surveys and registers (Uradni List RS, Št. 46/06 in 8/17, 1. Člen, 2006). KLASIUS classifies activities and outcomes based on their content similarities or differences. KLASIUS uses classification variables or criteria to compare the content of activities and outcomes (Official Gazette of the Republic of Slovenia, No. 46/06 and 8/17, Article 3). When collecting data and analysing them, we took into account the following classification of activities: 0. General educational activities/outcomes, 1. Educational sciences and teacher education, 2. Arts and humanities, 3. Social, business, administrative and legal sciences, 4. Natural sciences, mathematics and computer science, 5. Technology, production and construction, 6. Agriculture, forestry, fisheries and veterinary science, 7. Health and social sciences, 8. Services, and 9. Unspecified by broad area (According to a document from 2006).

Of all study programmes in Slovenia, 90.5% offer at least one subject that includes topics related to the environment or sustainability. Of these, 61.4% are compulsory and 38.6% are elective. Based on the data presented in Figure 31, we see that the majority of study programmes (36% of all programmes in Slovenia) are focused on natural sciences, mathematics and computer science, with most of these programmes being doctoral programmes (65% of all doctoral programmes in Slovenia) and master's programmes (46% of all master's programmes). The smallest share is covered by study programmes in the field of arts and humanities (1% of all Slovenian study programmes). The largest number of undergraduate study programmes (professional 22% and university 30%) is in the group of engineering, production and construction.
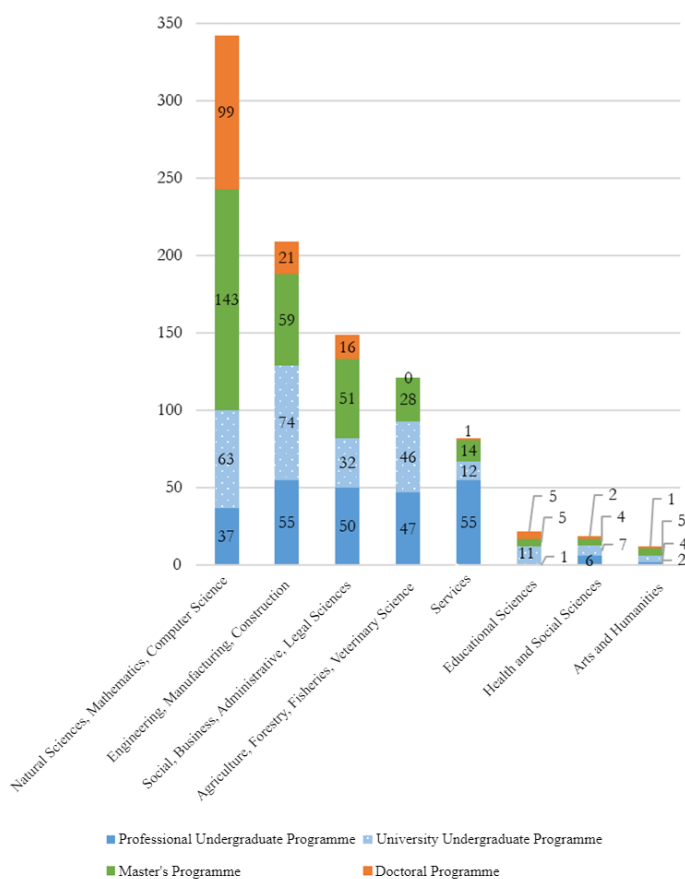
Figure 31: Number of study programmes by level and KLASIUS classification
Source: Own work.

Below, we have classified the study programmes into three groups based on the level of inclusion of sustainable content. If the study programme includes one or two courses with content from the field of sustainability, it is recognised as a programme with a low level of integration of sustainable content. If the study programme includes three to six courses from the field of sustainability, it is classified as a programme with a medium level of integration of sustainable content. Programmes that include seven or more courses from the field of sustainable development are classified as programmes with a high level of integration of sustainable content.

Based on the data presented, we can conclude that the majority of master's degree programmes have a high or medium level of integration of content from the field of sustainable development. A similar picture is also seen in doctoral study programmes. In university study programmes, the distribution between the three levels of integration is fairly even, while in higher education professional programmes, the majority are those that have a medium level of integration of sustainable content (Table 8).

Table 8: The level of inclusion of sustainable development content in study programmes according to the level of study

Level of integration by level of study	LOW	MEDIUM	HIGH
Higher professional studies	58	106	85
University studies	74	91	83
Master's studies	42	138	127
Doctoral studies	31	57	55

Source: Own work.

Next, we analysed the frequency of occurrence of keywords from the field of sustainable development in the contents of the study programmes and potential combinations of multiple keywords. The following keywords were analysed: green/environmental, ecology, environmental protection, circular economy, sustainable development, and social responsibility.

Since education for sustainable development must necessarily include an interdisciplinary aspect, an analysis of the simultaneous occurrence of two or three keywords was also carried out. The most intersections, 305, were between the fields of "ecology" and "environmental protection" and between "ecology" and "green/environmental", namely 293. There were 230 intersections between the fields of "green/environmental" and "ecology". All three keywords are found in 164

study programmes, which means that these programmes should be on the priority list of future environmental and sustainability experts who lead us to a more sustainable future (Figure 32).
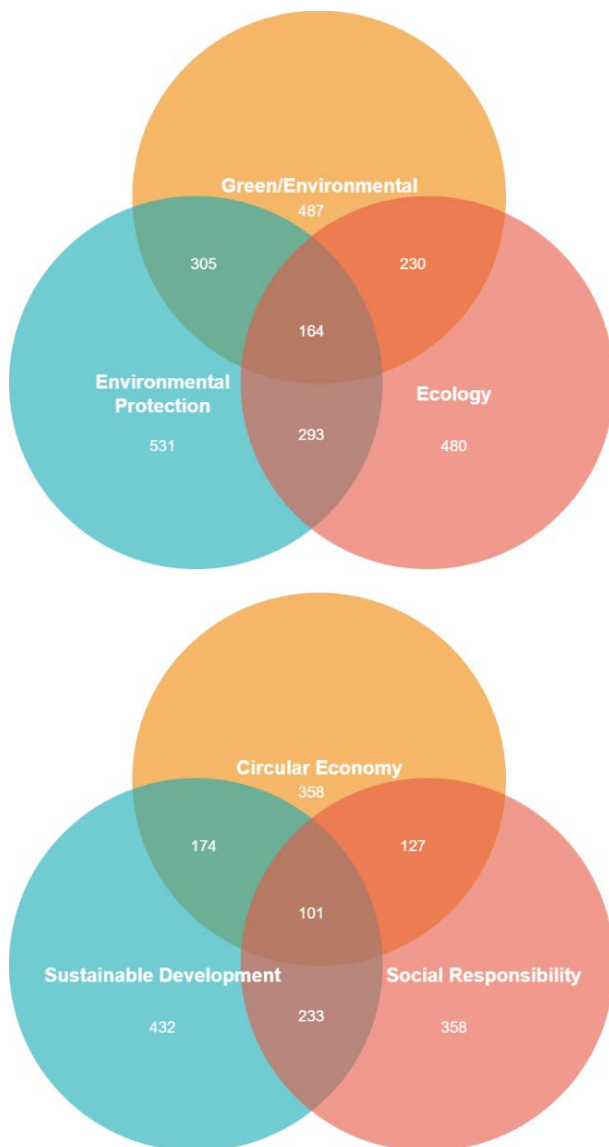
Figure 32: The three most common and three least common keywords in the field of sustainable development and their occurrence in higher education study programmes in Slovenia
Source: (Obrecht et al., 2022)

The keywords that were detected in smaller numbers were "sustainable development" (432 matches), "social responsibility" (358 matches) and "circular economy" (258 matches). The least represented combination of words was a combination of "circular economy" and "social responsibility", as only 127 programmes mentioned both topics in their curricula. A total of 101 programmes include all three less common keywords ("social responsibility", "sustainable development" and "circular economy") in their curricula.

3.2.1   Overview of the Inclusion of Sustainable and Digital Competencies in the Study Programmes of the FLUM

At the FLUM, we offer four study programmes: 1st cycle higher education professional programme titled Economic and Technical Logistics, 1st cycle university study programme titled System Logistics, 2nd cycle master's programme titled System Logistics, and 3rd cycle doctoral study programme titled System Logistics. Based on data freely available in the Catalogue of Study Programmes and Learning Units of the University of Maribor (*Katalog Študijskih Programov in Učnih Enot*, n.d.), we find that in the academic year 2021/2022, the FLUM offered 112 learning units. Approximately 60% of learning units are available at the undergraduate level, and slightly more than a quarter of learning units are offered at the master's level. The fewest learning units are available at the doctoral level (Table 9).

Table 9: Number of teaching units at the FLUM by individual study programme

Study programme	Frequency	Percentage
Higher education professional studies	33	29.5 %
University studies	32	28.6 %
Master's studies	29	25.9 %
Doctoral studies	18	16.1 %
Total	112	100 %

Source: Own work.

3.2.2   Current Integration of Sustainable Development Content in the FLUM Study Programmes

We analysed the inclusion of sustainable content in the learning units offered by the FLUM in the academic year 2021/2022. We measured the inclusion of sustainable content using seven binary nominal variables (0-no and 1-yes). In the curricula of

study programmes, we searched for the occurrence of the six previously mentioned keywords: "sustainability", "social responsibility", "circular economy", "green", "environmental protection", and "ecology". As the seventh criterion, we determined the inclusion of at least one of the above-mentioned words in the name of an individual course. By adding up all seven criteria, we obtained a numerical value of *the level of integration of sustainable content* into individual learning units, which has a value from 0 to 7.

Table 10 presents the frequency distribution of the inclusion of individual keywords in the curricula of study programmes at the FLUM. Based on the presented data, we can conclude that approximately every fifth learning unit of the FLUM contains "sustainability" as a keyword. All other keywords are represented in the FLUM curricula in less than 5%, except for the words "green" and "environmental protection", which are represented in just over 5% of units. 7% of the analysed learning units contain at least one of the six listed keywords.

Table 10: Frequency distribution of the inclusion of individual sustainability criteria in the FLUM study programmes

Criterion	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Sustainability	21	18.8	91	81.3	112	100
Social Responsibility	4	3.6	108	96.4	112	100
Circular Economy	3	2.6	109	97.3	112	100
Green	6	5.4	106	94.6	112	100
Environmental Protection	6	5.4	106	94.6	112	100
Ecology	1	0.9	111	99.1	112	100
Inclusion in the name of the subject	8	7.1	104	92.9	112	100

Source: Own work.

Table 11 presents the frequency distribution of the sustainability content integration level in the FLUM curricula. The presented results confirm that approximately every fifth learning unit has a value of the level of integration of sustainability content at least 1, with the lowest possible level of integration of sustainability dominating at 10.7%. The presented results show that no learning unit achieves the highest levels of integration of sustainability content (6 and 7), while just over 4% of learning units achieve levels of integration 2 and 3 in total, and just over 5% achieve levels of integration 4 and 5 in total.

Table 11: Frequency distribution of the level of integration of sustainability content into the FLUM study programmes

Level of integration of sustainable content	Frequency	Percentage
0	89	79.5 %
1	12	10.7 %
2	4	3.6 %
3	1	0.9 %
4	4	3.6 %
5	2	1.8 %
Total	112	100 %

Source: Own work.

From the results presented in the previous table, we can conclude that a total of 23 learning units offered by the FLUM in its study programmes in the academic year 2021/2022 integrate rich sustainability content. A more detailed overview of the learning units is shown in Appendix 1. Looking at these 23 units, we find that almost three-quarters of the learning units have a very low level of sustainability content integration of up to 3. In contrast, only 8% have a level of sustainability content integration of more than four on the 7-point scale (Table 12).

Table 12: Frequency distribution of the level of integration of sustainability content into the FLUM study programmes

Level of integration of sustainable content	Frequency	Percentage
1	12	52.2 %
2	4	17.4 %
3	1	4.3 %
4	4	17.4 %
5	2	8.7 %
Total	23	100 %

Source: Own work.

Finally, we were interested in how individual learning units with integrated sustainability content are distributed according to the study programme they are part of. The distribution is relatively even, with the most significant number of learning units, or a good third of all learning units, implemented at the FLUM and containing some sustainability content, being found in the master's degree programme (Table 13).

Table 13: Frequency distribution of the inclusion of individual sustainability criteria in study programmes at the FLUM

Study programmes at the FLUM	Frequency	Percentage
Higher education professional studies	5	21.7 %
University studies	6	26.1 %
Master's studies	8	34.8 %
Doctoral studies	4	17.4 %
Total	23	100 %

Source: Own work.

Results for individual study programmes show that the largest share of learning units with sustainability content is in master's and doctoral studies (more than 20.5%, higher than the total sum of all learning units at the FLUM). Undergraduate programmes are below average, with the least sustainability content found in the higher education professional programme, more than 5% less than the average sum of all programmes at the FLUM (Table 14).

Table 14: Inclusion of sustainable development content by study programme at the FLUM

Study programme	Number of learning units	Number of learning units with content	Share per study programme
Higher education professional studies	33	5	15.2 %
University studies	32	6	18.8 %
Master's studies	29	8	27.6 %
Doctoral studies	18	4	22.2 %
Total	112	23	20.5 %

Source: Own work.

3.2.3   Current Integration of Digital Content in the FLUM Study Programmes

We analysed the inclusion of digital content in the learning units offered by the FLUM in the academic year 2021/2022. The inclusion of digital content was measured using seven binary nominal variables (0-no and 1-yes), using a method similar to that employed for sustainability content. Based on the results of a focus group of experts in the field of digitalisation at the FLUM, we determined six keywords and checked their occurrence in the curricula of the FLUM courses:

- – digitalisation,
- – robotization,

- informatics,
- cybersecurity,
- automation,
- and computer.

The seventh criterion was the inclusion of at least one of the above-mentioned words in the name of an individual subject. By adding up all seven criteria, we obtained a numerical value of *the level of integration of digital content* in individual learning units, which can range from 0 to 7.

Table 15 presents the frequency distribution of the inclusion of individual keywords of digitalisation in the curricula of study programmes at the FLUM. Based on the data presented, we can conclude that, except for the word informatics and its synonyms, represented in approximately every third learning unit at the FLUM, all other keywords appear in less than 12% of learning units. Just over 13% of all learning units implemented at the FLUM contain at least one of the identified keywords in their name.

Table 15: Inclusion of sustainable development content by study programme at the FLUM

Criteria	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Digitalisation	7	6.3	105	93.8	112	100
Robotization	6	5.4	106	94.6	112	100
Informatics	40	35.7	72	64.3	112	100
Cybersecurity	6	5.4	106	94.6	112	100
Automation	11	9.8	101	90.2	112	100
Computer	14	12.5	98	87.5	112	100
Inclusion in the subject name	15	13.4	97	86.6	112	100

Source: Own work.

Table 16 presents the frequency distribution of the level of digital content integration in the FLUM curricula. The results show that just under half of all teaching units at the FLUM contain at least some digital content. Approximately a third of all teaching units have the lowest level of digital content integration (1 or 2), and no teaching unit reaches the highest levels of digital content integration of 6 and 7. The average level of digital content integration, between 3 and 5, is reached by slightly less than 14% of all teaching units.

Table 16: Frequency distribution of the level of integration of digital content into the FLUM study programmes

Level of digital content integration	Frequency	Percentage
0	61	54.5 %
1	28	25 %
2	7	6.3 %
3	9	8 %
4	5	4.5 %
5	2	1.8 %
Total	112	100 %

Source: Own work.

If 51 learning units with a level of digital content integration from 1 to 5 are viewed as a whole, we find that 86% of the learning units have a very low level of digital content integration – up to 3, and only 3.9% have a level of digital content integration of more than four on the previously defined and explained 7-point measurement scale (Table 17). A more detailed overview of the learning units is shown in Appendix 2.

Table 17: Frequency distribution of the level of integration of digital content into the FLUM study programmes

Level of digital content integration	Frequency	Percentage
1	28	54.9 %
2	7	13.7 %
3	9	17.6 %
4	5	9.8 %
5	2	3.9 %
Total	51	100 %

Source: Own work.

Finally, we were interested in how individual learning units with digital content are distributed according to the study programme they are part of (Table 18). Similar to sustainability content, the distribution is relatively even, with almost a third of all learning units implemented at the FLUM containing some digital content in the master's degree programme.

Table 18: Inclusion of content from the field of digitalisation by study programme at the FLUM

Study programme	Frequency	Percentage
Higher education professional studies	14	27.5 %
University studies	15	29.4 %
Master's studies	16	31.4 %
Doctoral studies	6	11.8 %
Total	51	100 %,

Source: Own work.

The results show that the master's degree programme has the largest share of learning units with included digitalisation content (more than 55%, which is 10% more than the share at FLUM), while the doctoral degree programme has the lowest share (Table 19).

Table 19: Inclusion of content from the field of digitalisation by study programme at the FLUM

Study programme	Number of learning units	Number of learning units with content	Share per study programme
Higher education professional studies	33	14	42.4 %
University studies	32	15	46.9 %
Master's studies	29	16	55.2 %
Doctoral studies	18	6	33.3 %
Total	112	51	45.5 %

Source: Own work.

3.2.4 Comparison of the Inclusion of Sustainable and Digital Content in the FLUM Study Programmes

We wanted to determine the degree to which digital and sustainable content are integrated simultaneously into individual FLUM courses and programmes. For this purpose, we first conducted a t-test to obtain an answer to the question of whether sustainable or digital content prevails in the FLUM courses. Learning units with a total integration of sustainability and digitalisation of 0 were excluded from the analysis. Based on the results of the t-test for dependent samples, presented in Table 20, we conclude that digital content is statistically significantly more prevalent in the FLUM curricula than sustainable content (Md = 1.55; Mt = 0.77; t = -2.703, p < 0.01). This further supports the fact that there are twice as many learning units with integrated digitalisation in the FLUM study programmes (51 or 45.53% of all FLUM

learning units) compared to learning units with integrated sustainable development content (23 or 20.54% of all FLUM learning units).

Table 20: Results of the dependent sample t-test comparing the level of integration of sustainable and digital content in the FLUM curricula

	Arithmetic mean	N	Standard deviation	Standard error of the arithmetic mean estimate	t	Statistical significance (one-tailed test)
Sustainability integration level	0.77	64	1.342	0.168	-2.703	0.004
Digitalisation integration level	1.55	64	1.344	0.168		

Source: Own work.

Table 21: Learning units at the FLUM that contain both sustainable and digital content

Name of the learning unit	Study programme	Level of integration of sustainability	Level of integration of digitalisation	Level of simultaneous integration of sustainability and digitalisation
German in Logistics 1	University	1	1	2
German in Logistics 2	University	1	1	2
Business Terminology and Communication in English 2	University	1	1	2
Business Processes in Logistics Systems	University	4	1	5
Supply Chain and Logistics Planning	Master's	2	1	3
Management Skills and Business Principles	Master's	1	1	2
Transport and Warehousing	Master's	1	1	2
Purchasing and Customer Service	Master's	1	1	2
Intralogistics 4.0	Doctoral	1	5	6
Circular Economy in Logistics	Doctoral	4	1	5

Source: Own work.

We wanted to determine how many FLUM learning units contain sustainable and digital content. We conducted an analysis to examine the inclusion of digital content for a subset of 23 learning units that contain at least some sustainable content. We found ten such learning units at the FLUM, representing just under 9% of all learning units implemented at the faculty (Table 21). Four such learning units are found in both the university and master's study programmes. No learning unit simultaneously integrates sustainable and digital content in the higher education professional programme. Over half of the presented learning units integrate sustainability and digitalisation evenly and at the lowest possible level 1.

3.3   Identification of Sustainable and Digital Competencies in Logistics and Supply Chains

We present the results of a quantitative survey, the primary purpose of which was to identify and precisely define the necessary competencies (knowledge, abilities and skills) in the field of sustainability and digitalisation in logistics and supply chains for a smooth and resilient transition to society 5.0. We included three groups of stakeholders in the research: employees in the business sector (companies in the field of logistics and companies that have a separate logistics department), students of logistics and related sciences, and the academic sector in the field of logistics. The obtained data represent starting topics for designing helpful lifelong training, representing additional value to interested organisations and logisticians.

3.3.1   Presentation of the Survey Questionnaire and the Research Process

For data collection, we have prepared a questionnaire that contains several sections. In the first phase, we pilot-tested the survey questionnaire with a small group of employees and students at the FLUM, and in this way, we avoided possible errors in the questions asked and unclear questions.

Considering that the survey questionnaire was intended for three different groups of respondents (the business sector in logistics, students and academics), certain questions were limited to a specific group. They were answered only by respondents for whom these questions were relevant. The survey questionnaire contains 28 questions, four open-ended and 24 closed-ended questions. A total of 15 questions addressed all three groups of respondents: 10 questions were addressed to business

organisations only, two questions were addressed to students only, and one additional question was addressed to the academic sector only.

The main objective of the research was to determine the necessary competencies (knowledge, abilities and skills) in sustainability, digitalisation and general (transversal) competencies in logistics and supply chains. As part of the first content set, we wanted to obtain the opinions of all groups of respondents, which refer to the currently needed competencies (knowledge, abilities and skills) and competencies (knowledge, abilities and skills) from the three mentioned areas, which will be needed in 5 years. With this, we tried to predict the need for the mentioned training, so the respondents answered these questions twice (assessment of current importance and importance in 5 years). This set of questions contains:

–   22 competencies (knowledge, abilities and skills) in the field of sustainable development in logistics and supply chain management,
–   21 competencies (knowledge, abilities and skills) in the field of digitalisation in logistics and supply chain management,
–   and 33 transversal competencies (knowledge, abilities and skills) needed in logistics and supply chain management.

The starting point for the preparation of questions related to the field of competencies was the competency models presented in Chapter 2.4. In addition to assessing the importance of previously presented competencies (within the first content set), we wanted to determine whether the respondents consider competencies (knowledge, abilities and skills) in sustainable development or knowledge in digitalisation to be more important. At the end of thematic group 1, the respondents were expected to choose five training courses from the three sets of training courses offered (sustainability, digitalisation and general/interdisciplinary) that represent the most significant added value for them.

The second thematic set of the survey questionnaire contains several questions relating to the socio-demographic profile of the respondents: gender, age, highest level of education completed, field of formal education, and primary status in the labour market. For respondents who are employed, we were also interested in the size of the organisation in terms of the number of employees, the sector in which the organisation operates, the respondent's workplace, the international orientation

of the work organisation and the name of the company in which they are employed, which was not a mandatory answer.

 With the third thematic set of the questionnaire, we wanted to determine how the respondents assess their "sustainable" lifestyle. This set contains the following items:

–   12 statements related to lifestyle and quality of life,
–   seven statements related to care for the environment,
–   and six statements related to concern for future generations and the conservation of resources.

Respondents rated the degree of agreement with individual statements on a 5-point scale, where one means "not true for me at all", and five means "completely true for me". We used standardised measurement scales, which were adapted and slightly modified for the needs of the research (Quoquab et al., 2019).

The fourth thematic group contains questions intended for the sustainable operation of organisations and, therefore, intended only for respondents employed in the business and academic sectors. We wanted to find out how respondents evaluate the sustainable functioning of organisations. Thematic set 4 contains the following elements:

–   eight statements that refer to compliance with sustainable product planning guidelines,
–   seven statements relating to the use of sustainability principles in the business process,
–   seven statements relating to the use of sustainability principles in the management of supply chains,
–   and five statements relating to applying sustainable management principles at the end of the life cycle.

Respondents rated the degree of agreement with individual statements on a 5-point scale (from 1 – does not comply/uses at all to 5 – fully complies/uses). The measurement scales were adapted and slightly modified to the research needs (Ibrahim et al., 2020). This thematic set contains two additional open-ended questions, in which employees in organisations were given the opportunity to

highlight the knowledge needed in the field of logistics. Answers were collected separately for employees in the business and academic sectors. The questions were optional for the respondents.

The fifth and final thematic group, which was intended only for students, focused on how frequently individual pedagogical approaches are used in study activities and to what extent such approaches motivate students. For ten pedagogical approaches, students rated the frequency of use on a 5-point scale (from 1 – is never used in studies to 5 – is very frequently used in studies) and the level of motivation (1 – does not motivate me at all to 5 – motivates me very much). This thematic set contains one additional open-ended question, in which students were given the opportunity to highlight the logistics competencies they believe should be acquired during their education. The question was optional for the respondents.

The research was conducted from December 2022 to June 2023. Three groups of respondents participated in the research were: the academic sector in logistics, students of logistics and employees in business organisations in logistics, and companies with a separate logistics department. The research was carried out in the entire area of Slovenia.

The survey questionnaire was prepared electronically using the 1ka.si tool. We sent it to employees in the academic sector and students via e-mail. An external contractor was responsible for contacting the business sector and collecting data from logistics companies/companies with a separate logistics department. We obtained 739 responses, of which 85.9% were from the business sector, 10.8% from students and the rest from academics. The distribution is intentionally such that the largest share of responses is from the business sector, as the population of companies or employees in the logistics sector is significantly larger than the population of students and academics in logistics.

The number of answers to individual questions varies, as not all questions were intended for all groups of respondents. There were also no mandatory questions. Even though we included all 739 responses in further analysis, none of the questionnaires had more than 25% of the responses missing. Because of this, the total number of answers varies for different questions, but this does not affect the results' quality. All answers were entered and analysed using the SPSS 28 software package.

3.3.2   Sample Description
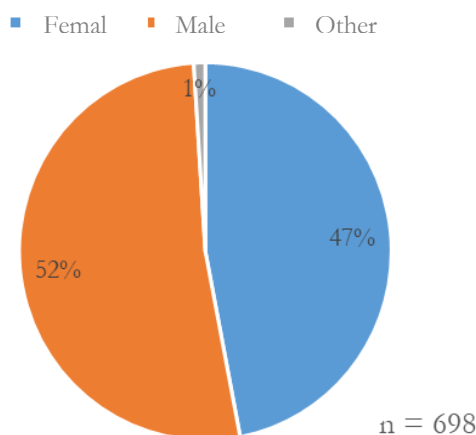
Figure 33 shows the data related to the respondents' gender – 5% more men than women
participated in the survey.

Figure 33: Gender of respondents
Source: Own work.

Table 22 presents data on the age of the respondents. The average age of the
respondents was 41.1 years, and the maximum age was 42. The youngest respondent
was 18, and the oldest was 66. The respondents were categorised into four age
groups.

Table 22: Age of respondents

Age by category			
	f	f (%)	cumulatively (%)
Between 18 and 30 years	119	17.3	17.3
Between 31 and 40 years	179	26.1	43.4
Between 41 and 50 years	251	36.6	80
Between 51 and 66 years	137	20	100
Together	686	100	

Source: Own work.

The level of education of the respondents is presented in Figure 34. Most
respondents (32 %) have completed a vocational or 4-year school. 52 % have
completed a higher vocational or lower level of education, and 48 % have completed
a higher professional (first Bologna) or higher level of education.
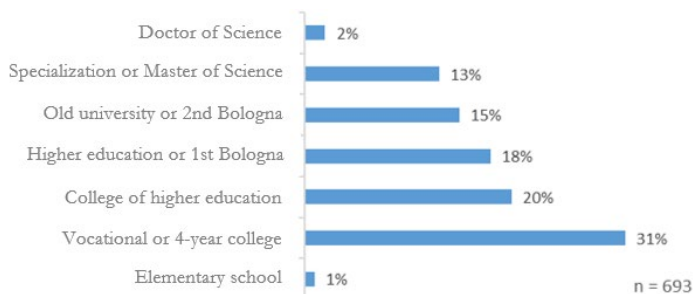
Figure 34: Level of education of respondents
Source: Own work.

Figure 35 shows the frequency distribution of responses by the field of education. Most respondents have a formal education in logistics or traffic (29 %). In second and third place is a formal education in business or economics (27 %) and technology (24 %). This is followed by respondents with formal education in the field of social sciences (10 %), and the remaining respondents who do not have any of the mentioned fields of education (10 %).
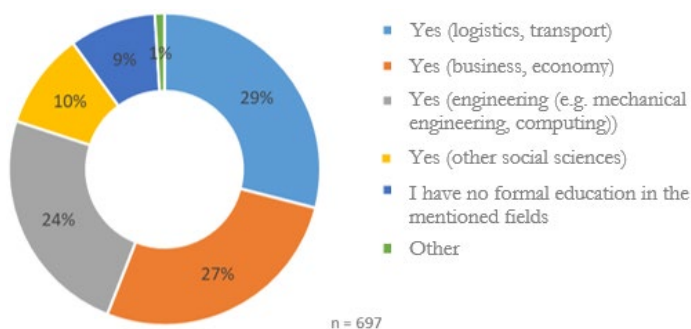
Figure 35: Field of acquired education of the respondents
Source: Own work.

With the research, we wanted to examine the perspective on the necessary knowledge in the future from several viewpoints: the business sector, students and academics. Employees accounted for the largest share of respondents, just under 89 %. Of these, 86 % were employed in logistics and supply chain companies, and 3 % were professors teaching in logistics programmes. Students follow with just under 11 %. Two respondents were retired (Table 23).

Table 23: Primary status of respondents

Primary status			
	f	f (%)	cumulatively (%)
Employed, self-employed	617	88.9	88.9
Student	75	10.8	99.7
A pensioner	2	03	100
Together	694	100	

Source: Own work.

In the survey, we wanted to cover a uniform sample in terms of the size of the company, as seen in the results (Figure 36). Only respondents with the primary status of employees answered this question. 34 % of the respondents are employed in a small company, 36 % in a medium-sized company and 25 % in a large company. Employees from micro-enterprises represent a smaller share (5 %).
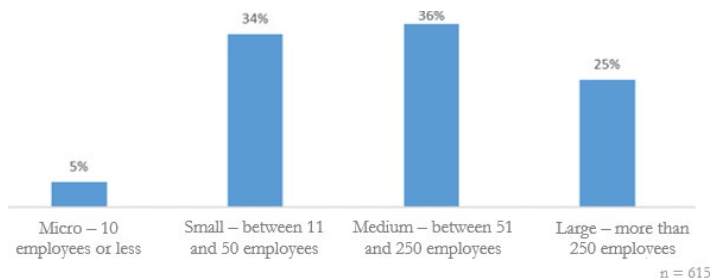
Figure 36: Company size
Source: Own work.

Table 24: Frequency distribution of organisations by sector

In which sector does your organisation operate?	f	f (%)	cumulatively (%)
Forwarding, transport, logistics services	227	36.9	36.9
Trading activity, wholesale	168	27.3	64.2
Production	79	12.8	77
Service business	71	11.5	88.5
Craftsmanship (e.g., hairdresser, metalworker, electrician, etc.)	28	4.5	93
Education/Research	21	3.4	96.4
Public sector (e.g., municipal administration, ministries, administrative units, etc.)	17	2.8	99.2
Non-governmental non-profit organisation	5	0.8	100
Together	616	100	

Source: Own work.

Only those with primary employment status responded to the question regarding the sector in which the organisation, where the respondents are employed, belongs. Most of them are employed in companies belonging to the "Forwarding, transport, and logistics services" sector (Table 24).

According to the position of the respondents in the organisation, the largest share of respondents were "department heads" (37 %), followed by "employees" without additional responsibilities (35 %), "leaders of small groups" (24 %), and a smaller share represented by "owners or directors " (4 %) (Figure 37).
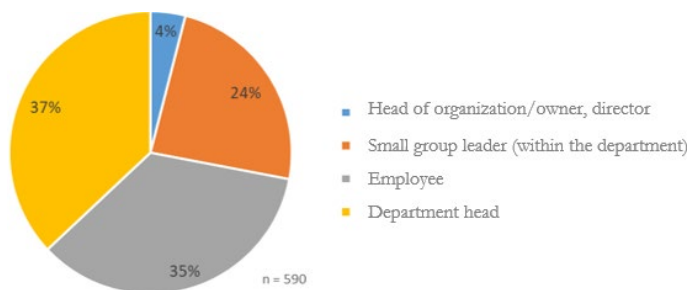
Figure 37: Respondent's position in the organisation
Source: Own work.

Figure 38 shows that the largest share of organisations (33 %) where the respondents work also do business in the EU and the European Economic Area. 31 % of organisations do business only in Slovenia. 25 % also do business with neighbouring countries and/or the countries of the former Yugoslavia. The smallest share (11 %) was those doing business also outside the EU and the European Economic Area (EEA).
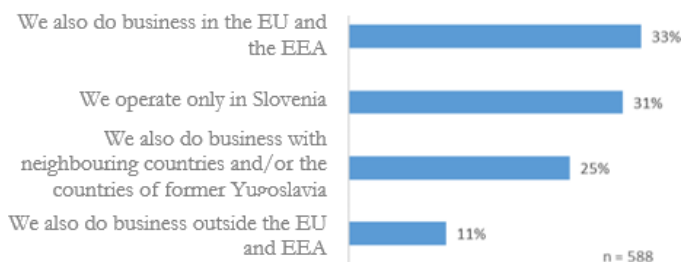
Figure 38: International orientation of organisations
Source: Own work.

3.3.3   Perceived Competencies of Employees in the Field of Logistics and Supply Chains

In the context of this thematic group, we were interested in identifying which sustainable, digital and transversal competencies (knowledge, abilities and skills) respondents currently perceive as necessary and how they assess their relevance and importance 5 years from now. In this way, we identified key gaps in knowledge, abilities and skills that the respondents perceived as necessary in logistics and supply chain management. In this way, we also indirectly determined the motivation to acquire new knowledge from the mentioned fields among all three groups of respondents (the business sector, students and academics).

For all three groups of competencies (sustainability, digitalisation and transversal competencies in logistics), we found differences in the average estimates of the current need for knowledge, abilities and skills and the need in five years. Average scores for all mentioned competencies were higher for 5 years from now than now. In this way, we confirmed the relevance of knowledge, abilities and skills related to the issue under consideration.

Figure 39 shows the average assessment of gaps in competencies in the field of sustainable development. Based on the presented results, we can conclude that the respondents perceive the largest average deviations (around 1) in the following contents: calculation of the environmental/carbon footprint, use of degradable and smart packaging, compliance with all aspects of sustainable development, care for the environment, following sustainable development guidelines and green ordering.

Figure 40 presents the average assessment of gaps in competencies in digitalisation. Based on the presented results, we can conclude that the respondents perceive the most significant average deviations (more than 0.9) in the knowledge of cyber and information security and rights and licenses that apply to digital information and content.

Figure 41 shows the average ratings of gaps in transversal competencies in logistics and supply chain management. Based on the presented results, we can conclude that the respondents perceive the most significant average deviations (around 0.9) in knowledge related to the concept of Industry 4.0, systems thinking and research-oriented thinking.
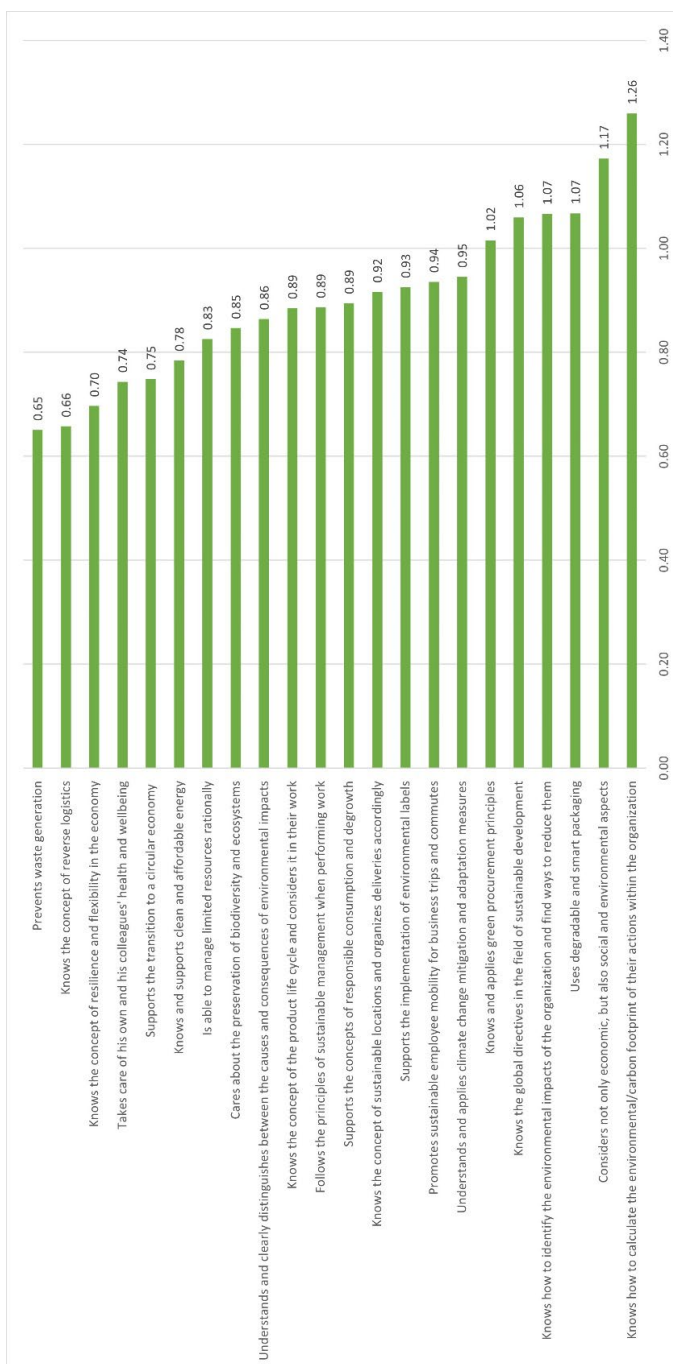
Figure 39: Average scores of competency gaps in the field of sustainable development
Source: Own work.
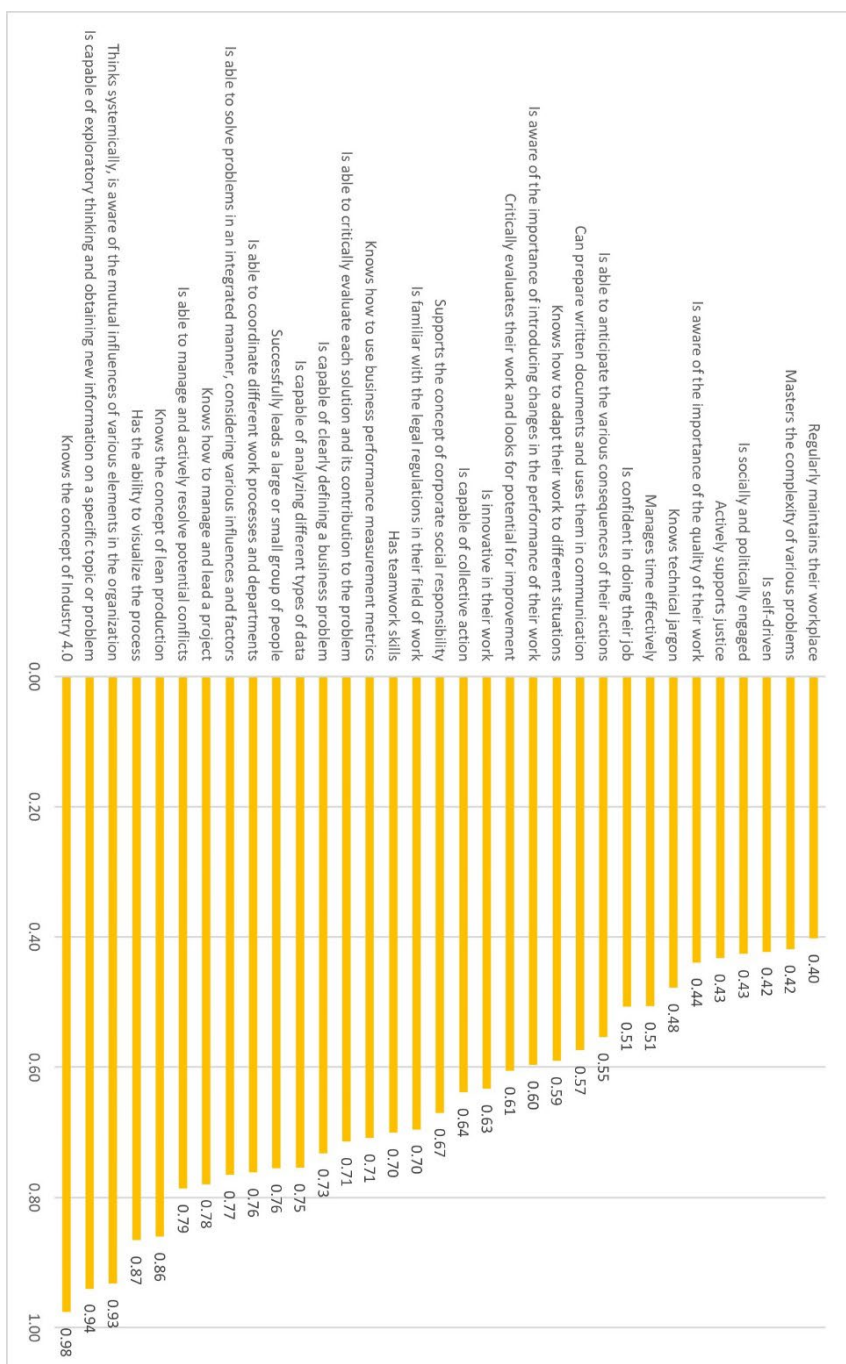
Figure 41: Average cross-competency gap scores in logistics and supply chains
Source: Own work

Figure 42 shows the results of the question in which the respondents were asked to show their interest in topics from the field of sustainability that would be of interest to them regarding the offer of shorter training courses/workshops and represent the most significant added value to them. As with the previous question, which referred to the field of digitalisation, it was also possible to mark/select five training topics this time. All responses on the graph are presented in percentages. More than 40% of all respondents were most interested in the following five topics: circular economy, corporate social responsibility/environmental, social and governance aspects (ESG), renewable energy sources and energy self-sufficiency, sustainable and smart packaging, and sustainable mobility for businesses.
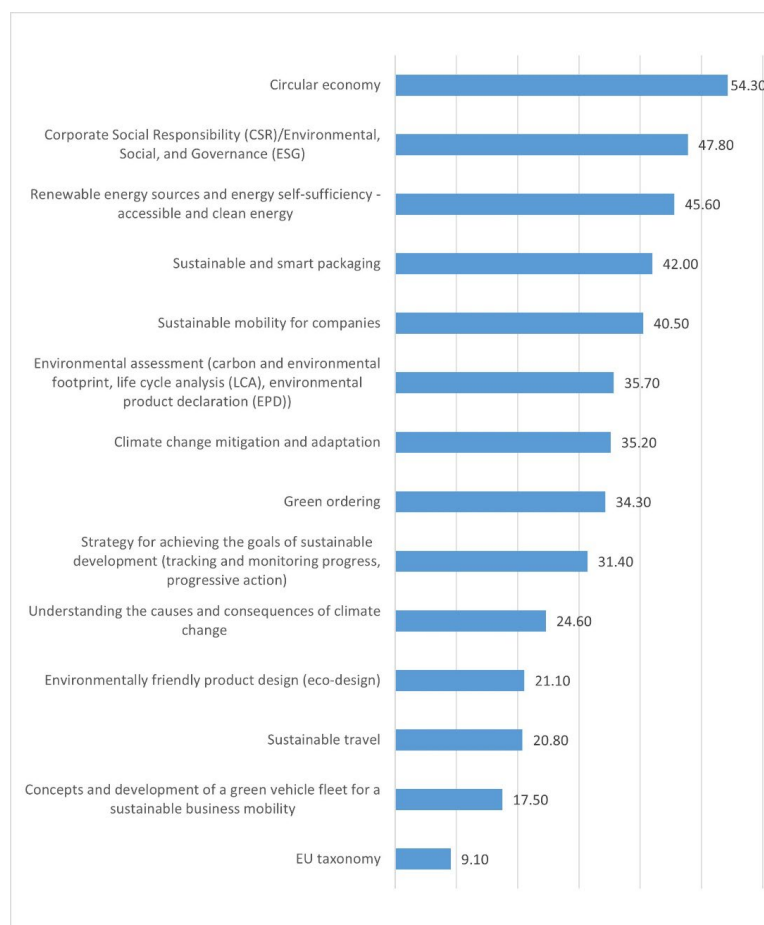
Figure 42: Priority training courses in the field of sustainability
Source: Own work.

Figure 43 shows the results for the question that asked the respondents to show their interest in topics from the field of digitalisation that would be of interest to them in terms of the offer of short training courses/workshops and represent the most significant added value to them. It was possible to mark five answers; all responses on the graph are presented as percentages. Based on the results, we conclude that the most significant interest, more than 40%, is in the following topics: digitalisation of business processes - planning and implementation, optimisation and use of digital technologies for a green transition, analysis and processing of large amounts of data, communication and cooperation in a digital environment, and automation and robotics and machine learning.

Figure 43: Priority selection of training courses in the field of digitalisation in logistics and SC
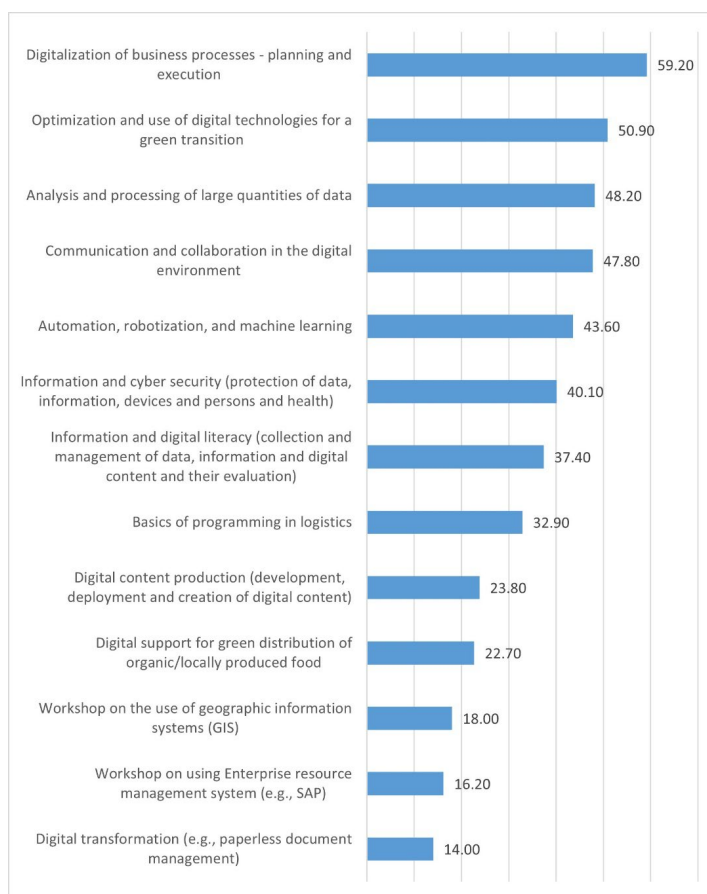Source: Own work.

Figure 44 shows the results for the question in which respondents were asked to show interest in topics from the field of general logistics that would be of interest to them in terms of offering shorter training courses/workshops and represent the most significant added value to them. As with the previous question, which referred to the field of digitalisation, it was also possible to mark five training topics this time. All responses on the graph are presented in percentages. The five topics that more than 40 % of respondents expressed interest in are the impact of procurement on a company's bottom line, resilience and sustainability in supply chains (SC), understanding supply chain disruptions, how the supply chain works, and agile and lean manufacturing/logistics.
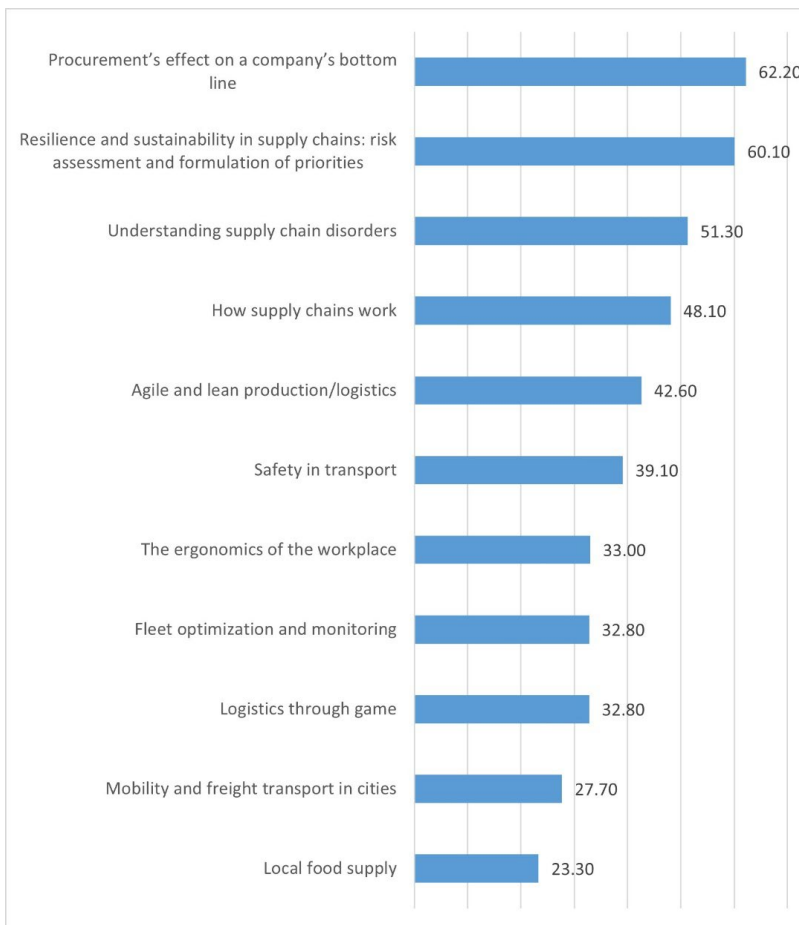
Figure 44: Priority selection of general training courses in the field of logistics and SC
Source: Own work.

We were interested in whether competencies (knowledge, abilities and skills) in sustainability or digitalisation are more important to the respondents. The respondents showed their preference for one or another concept on an 11-level semantic differential scale. Their answers were categorised based on the importance rating of one set or another. Based on the answers presented in Figure 45, we observe that just over half of the respondents are more inclined towards sustainability, which is 14 % more than towards digitalisation. 8 % of the respondents attribute the same importance to digitalisation and sustainability. The results can be interpreted in connection with the results related to the inclusion of sustainable and digital content in study programmes in logistics. Considering the finding that we have approximately twice as many teaching units with content in the field of digitalisation compared to the content in the field of sustainability, the fact that there are more such respondents for whom competencies in the field of sustainability are more important is encouraging, as it can indirectly represent a positive motivation for further education and development of these competencies.
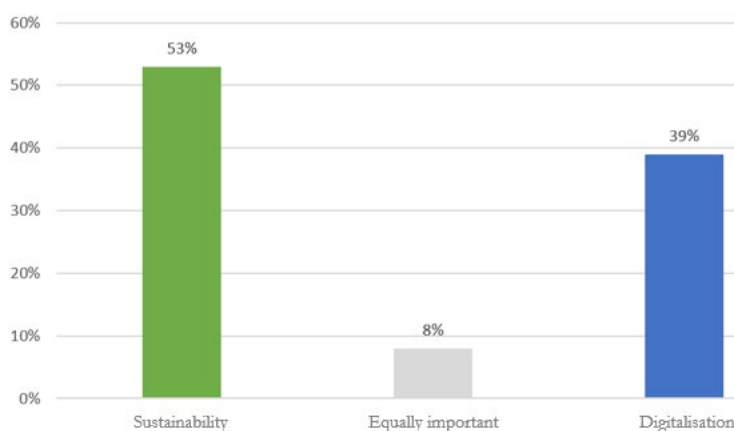
Figure 45: Which are more important to you, sustainability or digitalisation competencies?
Source: Own work.

3.3.4   Differences in Perceptions between Target Groups

In the following, we were interested in whether there are statistically significant differences in the assessment of gaps in competencies (knowledge, abilities and skills) for the three previously defined thematic groups: sustainable competencies, digital competencies and transversal competencies. For each group of competencies, we performed the Kruskal Wallis H test and compared the average values of the

ranks. In the following, we present the differences by sets for knowledge, abilities and skills, for which statistically significant differences were detected at the characteristic level p <0.05.

Figure 46 presents nine competencies (knowledge, abilities and skills) from the field of sustainable development, for which statistically significant differences were found. Based on the average rank values, we can conclude that employees in companies place the most importance on almost all the competencies presented, whereas students' ratings are significantly lower. The only exception is the statement "Understands and clearly distinguishes the causes and consequences of environmental influences", which respondents with the status of academics (professors) rated as the most important compared to the other groups.

Figure 47 shows statistically significant differences in assessments of gaps in knowledge, skills and competencies in digitalisation. Statistically significant differences were found for 14 statements. Based on the presented results, we can conclude that compared to the other groups of respondents, students gave the most importance to the statement "Knows how to edit, store and manage data, information and content in digital environments". Compared to other groups of respondents, respondents with academic status (professors) ranked as more important the use of innovative tools and technologies for creating innovative processes, products, and knowledge in the digital environment, and knowledge of programming and automation concepts. Respondents from the business sector rated all other 12 statements from the field of digitalisation as the most important compared to other groups of respondents.

Statistically significant differences in assessments of gaps in transversal knowledge, abilities and skills are presented in Figure 48. Statistically significant differences were observed for 21 statements. Similar to the two previous sections, based on the results presented, we can conclude that employees in the business sector rate 20 statements as more important compared to the other groups. The only claim highlighted as the most important only by the respondents with the status of an academic (professor) is "can critically evaluate an individual solution and its contribution to the problem".

Figure 47: Statistically significant differences in the assessment of competency gaps in the field of digitalisation
Source: Own work.
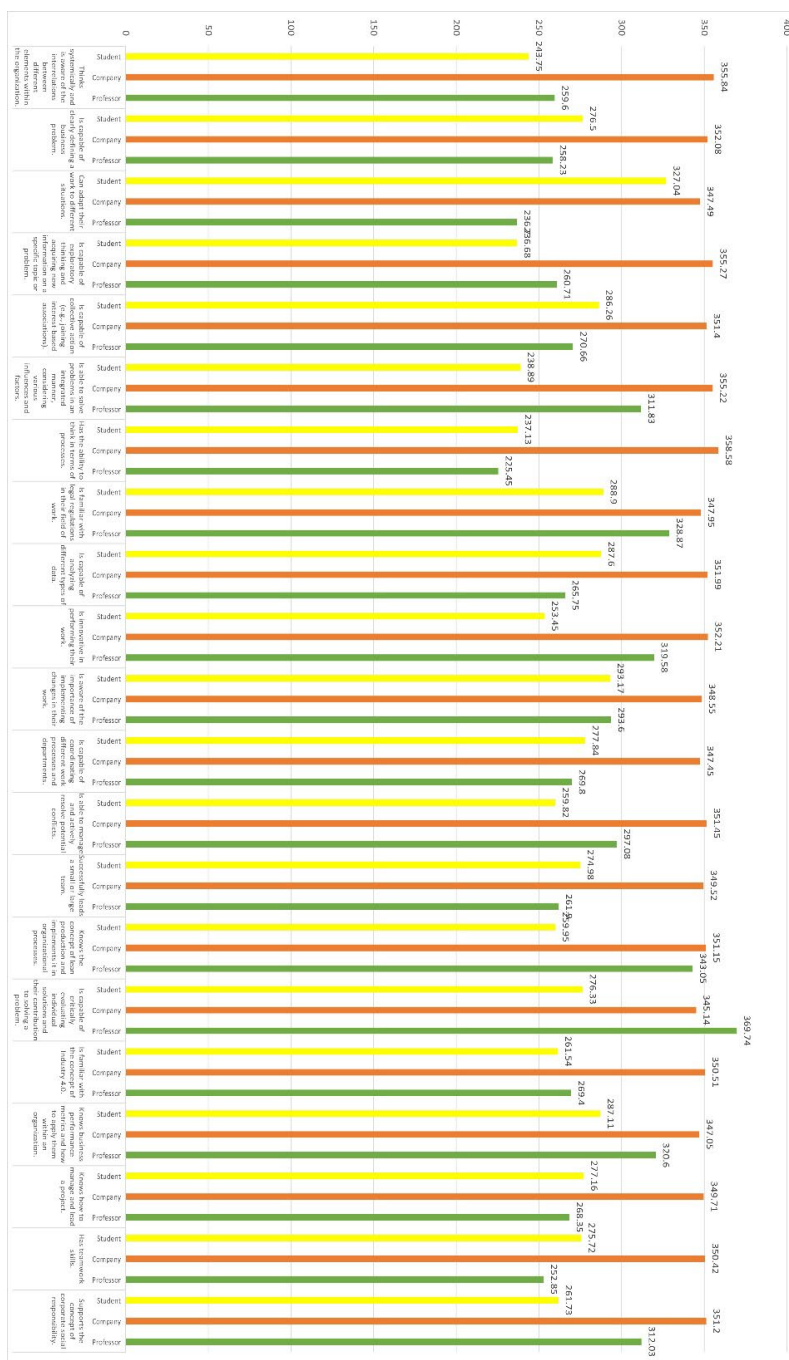
Figure 48: Statistically significant differences in cross-competency gap scores
Source: Own work.

Based on the presented results, we can conclude that employees in the business sector in the field of logistics generally place great importance on developing the presented green, digital and transversal competencies, which is encouraging. Compared to other groups, academics (professors) highlighted knowledge, abilities and skills related to environmental impacts, critical evaluation of solutions, knowledge in programming, automation and creating processes in a digital environment. Respondents with the status of a student rated the need for the development of the presented skills the lowest on average, which was also expected, given that they are mostly younger generations who already have these contents more integrated into formal education and who are more inclined to sustainable behaviour and functioning in the digital environment. Accordingly, they rated as the most important the importance of editing, storing and managing data in digital environments.

3.3.5   Respondents' Perception of Lifestyle Sustainability

As part of the third part of the survey, we wanted to examine the sustainability orientation of the respondents in their everyday lives. For this purpose, we used three scales: lifestyle and quality of life (12 statements), concern for the wellbeing of the environment (7 statements) and concern for future generations (6 statements). Respondents expressed their level of agreement with the statements on a 5-point scale (from 1 – not true for me at all, to 5 – completely true for me).

Table 25 presents the descriptive statistical analysis results for the lifestyle and quality of life. Based on the results, we can conclude that the respondents perceive their lifestyle as sustainable, as the average ratings of four statements are higher than four, and only one statement was rated below 3. Based on the presented results, we conclude that the respondents are most concerned about reducing food waste, reusing, and reducing the number of used bags. On average, they pay less attention to receiving advertising mail, less often decide to buy products with biodegradable packaging, and on average, they carefully plan each purchase.

Table 25: Descriptive statistical analysis - lifestyle and quality of life

Variable, n = 667	Spacing	Min	Max	Arithmetic mean	Standard deviation
I do not like to throw away food and drink.	4	1	5	4.43	0.827
At a restaurant, I only order as much food as I can eat to avoid throwing food away.	4	1	5	4.30	0.934
I use a shopping bag several times/regularly use a reusable bag.	4	1	5	4.22	0.860
I try to reuse/recycle my old things in every possible way (for example, I donate old clothes to those who need them).	4	1	5	4.15	0.875
I reuse office paper by writing on the other side.	4	1	5	3.99	0.985
I avoid excessive use/consumption of goods and services (e.g., I print documents only when necessary).	4	1	5	3.97	0.827
I always try to reduce the excessive use of goods and services (e.g., I turn off the light or ventilation when not in the room).	4	1	5	3.89	0.681
I avoid excessive and unnecessary purchases.	4	1	5	3.57	0.786
I carefully plan every purchase of a product or service.	4	1	5	3.45	0.874
I recycle daily newspapers or reuse them for other purposes.	4	1	5	326	0.988
I choose to purchase product(s) with biodegradable packaging.	4	1	5	3.20	1.040
I have a sticker on my mailbox saying I do not want to receive advertising mail.	4	1	5	2.86	1.685

Source: Own work.

Table 26 presents the descriptive statistical analysis results for the construct concern for the wellbeing of the environment. Based on the results, we can conclude that the respondents perceive their behaviour in everyday life as being oriented toward caring for the wellbeing of the environment. The statement "I like our planet" received the highest average rating, while statements related to the purchase and use of organic and environmentally friendly products received lower average ratings.

Table 26: Descriptive statistical analysis - concern for the wellbeing of the environment

Variable, n = 667	Spacing	Min	Max	Arithmetic mean	Standard deviation
I love our planet.	4	1	5	4.38	0.836
I am concerned about the lack of natural resources.	4	1	5	3.93	0.800
I prefer to use a paper bag as it is biodegradable.	4	1	5	3.73	1.008
I care about the natural environment.	4	1	5	3.50	0.797
I buy and use environmentally friendly products.	4	1	5	3.42	0.831
I often pay extra money to buy an environmentally friendly product (e.g., organic food).	4	1	5	3.37	0.942
I use organic products and services.	4	1	5	3.29	0.978

Source: Own work.

Table 27: Descriptive statistical analysis - concern for future generations

Variable, n = 667	Spacing	Min	Max	Arithmetic mean	Standard deviation
I worry about the future generation.	4	1	5	3.92	0.829
I often think about the quality of life of future generations.	4	1	5	3.69	0.881
I am trying to control my urge to overshop for the sake of future generations.	4	1	5	3.56	0.906
I try to reduce excessive consumption as much as possible to preserve environmental resources for future generations.	4	1	5	3.55	0.906
I care about meeting the needs of the next generation.	4	1	5	3.49	0.814
I always remember that my excessive consumption may create obstacles for future generations to meet their basic needs.	4	1	5	3.41	0.832
I use organic products and services.	4	1	5	3.29	0.978

Source: Own work.

Table 27 presents the descriptive statistical analysis results for the construct concern for future generations. Based on the presented results, we can conclude that the respondents perceive, on average, that they care for future generations with their everyday actions, as they rated the statement "I care about the future generation" with the highest average score. Nevertheless, based on the presented results, we can conclude that the average respondents do not show a more precise awareness of

what can be caused by excessive consumption of resources and excessive shopping, which is indicated by the scores of all other statements, which range around 3.5.

The perception of an individual's lifestyle and quality of life, concern for the well-being of the company and concern for future generations are the essential areas with which we can gain insight into a comprehensive picture of how much individuals are aware of the importance of sustainability in everyday life and which of these umbrella areas they prioritize. As a result, the results from which we obtain helpful information about the sustainable behaviour of individuals in everyday life represent an excellent starting point for further research and adaptation of content in lifelong education. Individuals who are more inclined towards sustainable behaviour in everyday life are expected to show a greater interest in further education and training in this field.

3.3.6   Logistics Students' Perception of the Use of Innovative Pedagogical Approaches

At the end of the research, we wanted to find out how often different innovative pedagogical approaches are used in logistics study programmes and to what extent such approaches motivate students in their studies. The results are presented in Table 28. Generally, we find that for all presented pedagogical approaches, the rule applies that their average rating of motivation is higher than the average rating of the frequency of use of an individual approach. The three approaches that motivate the respondents the most are case studies, group challenges to solve a concrete problem and field trips to real environments.

As already mentioned, the frequency of use of all mentioned approaches is below average (the average scores for the frequency of use for all approaches are below 3). However, the most frequently used are relevant software tools from the field of study, quizzes in the online environment, and challenges of jointly finding solutions for a given case. When calculating the differences between the level of motivation and the frequency of use of each approach, we can see that gamification, field trips, and educational debate are the three approaches that could be most effective in the future in providing content from the field of logistics. Based on the results, we can more easily create education for the future, which will encourage a green and digital transition and integrate gamification, field trips, and debates to a greater extent.

Table 28: Frequency of use and motivation to study logistics when using different pedagogical approaches

Pedagogical approach, n = 70	Arithmetic mean of frequency of use in existing study process	Arithmetic mean of motivation level (if used to a greater extent)	Absolute difference
Use of relevant software tools in the field of study.	2.46	3.32	0.86
Quizzes in an online environment.	2.42	3.44	1.02
Challenges where we find possible solutions for a given case as a group.	2.39	3.81	1.42
Videos explaining advanced concepts.	2.37	3.61	1.24
Case studies where we review existing solutions in the classroom.	2.36	3.84	1.48
Flipped learning, where students process the material independently and summarise it in the lecture room.	2.34	3.16	0.82
Field trips to real environments.	2.19	3.8	1.61
Gamification of studies, where students gain additional points while completing assignments.	2.16	3.79	1.63
Possibility of participation in professional meetings/conferences.	2.00	3.5	1.5
An educational debate in which opposing teams (advocates and negators) present their positions and debate the debate claim.	1.84	3.42	1.58

Source: Own work.

4   Conclusions

Understanding the basic concepts of sustainable development enables individuals to understand the common efforts to preserve the environment, social justice and economic stability. We must learn how to meet current needs differently without jeopardising the ability of future generations to meet their own needs. Changing the way we think starts with the individual, even though the economy and individual companies within it also play a major role on a global level. Awareness of the importance of key concepts in sustainable development and their integration into society, politics, and the economy is therefore crucial for shaping a sustainable future, critical assessment, problem-solving, and cooperation. The presented results for how trends in sustainable development are followed are encouraging, as they clearly demonstrate the concrete benefits they bring to the individual, the environment and society as a whole. Young people play an important role as future innovators and decision-makers, who should not be the only ones carrying the burden of the transition to a carbon-free society. The same applies to digitalisation, the rational use of which contributes to better resource management, efficient energy use, greater efficiency and innovation, which can also contribute to carbon footprint reduction. Again, young people have a key role to play in this, and it is therefore of utmost importance to encourage the positive and responsible use of digital technology and media among young people, together with the development of digital skills that help them face the challenges of the digital world.

Developing sustainable and digital competencies is key in promoting society's resilience and progress towards Society 5.0, emphasising the integration of human, technological and environmental aspects. Sustainable competencies refer to the abilities, knowledge and skills that enable the sustainable development of society. This includes understanding and awareness of the impact of human activities on the environment, society, and the economy. Understanding the climate crisis, biodiversity loss, pollution, and environmental issues is crucial in managing current and future sustainability challenges and achieving greater resilience to disruptions and upcoming changes. On the other hand, social awareness, which includes understanding social inequalities, the inclusion of vulnerable groups and the promotion of social justice, represents the basis for responsible behaviour and sustainable resource management, which is not focused exclusively on economic indicators of the economy, but primarily on the economy of wellbeing and wellbeing itself. Digital competencies refer to the knowledge, skills and abilities related to information and communication technology. They are based on the knowledge necessary to understand the use of computers, the Internet, the Internet of Things, cloud services, digital tools and platforms, and the ability to critically evaluate data and, last but not least, information security. The ability to process and analyse data and make decisions based on data is crucial, especially in achieving resilience in the business sector. To fully demonstrate the importance of digital competencies, it is necessary to highlight the ability to develop and manage digital applications and understand the basics of programming and the principles of artificial intelligence.

For the smooth development of a society resilient to perceived challenges, it is essential to develop sustainable and digital competencies simultaneously. These areas are not mutually exclusive, as the transition to Society 5.0 encompasses sustainable development, in which digital technologies improve people's lives and preserve the environment. Digitalisation enables better monitoring and management of resources, leading to reduced waste and a more sustainable use of energy and raw materials. Smart digitalisation also enables more efficient time management. Through digital technologies and information on environmental issues, sustainable practices and opportunities for sustainable operations are becoming more accessible. Due to the requirements of the CSRD Directive, environmental declarations, the introduction of the EU taxonomy in financial institutions, and the mandatory calculation of the carbon footprint for certain companies and products, there will be an increasing amount of such information in electronic form. The direct benefit of Society 5.0 will also be visible in better management of smart cities and communities,

reduction of pollution and improvement of the quality of life of local communities. The concrete benefits of smart city development in later stages are evident in examples such as remote working, which reduces the need for transportation, and, in turn, lowers greenhouse gas emissions. Additionally, improved health services, such as the digitalisation of healthcare, enable better diagnostics and treatment, reduce the burden on the healthcare system and consequently improve the health of residents. Above all, digitalisation fosters critical thinking and necessitates changes to the current consumerist lifestyle, which places an excessive burden on our planet, as we exceed the Earth's capacity for self-renewal processes.

In addition to understanding the positive impacts, it is also necessary to understand the negative impacts of the interplay between these two areas, particularly the adverse impact of digitalisation on the sustainable development of each individual and society as a whole. In the first phase, the production of electronic devices consumes large amounts of energy and resources, which directly burdens the environment. During their usage phase, enormous amounts of energy are required. Cloud services are not only in the cloud but also require physical energy and are based in physical, not virtual, computing centres. Furthermore, rapidly changing technology leads to an increasing amount of electronic waste, which contains various toxic substances. Negative impacts on the social dimension of sustainable development are mainly reflected in the creation of social inequality between those who have access to digital technologies and those who do not. On the other hand, excessive dependence on digital technologies can lead to problems in an individual's personal life, such as higher stress levels, reduced social contact, sleep disturbances, addiction, and generally poorer wellbeing. It is also necessary to highlight the vulnerability to cyberattacks, which can have negative consequences for society as a whole, as well as the issue of privacy protection and the ethical collection and use of large amounts of personal data.

For the further development of sustainable and digital competencies, it is essential to focus on the positive effects of the interplay between these two areas while remaining aware of the adverse effects, especially those that digitalisation may have on sustainable development. The long-term result of such development is a sensible transition to society 5.0, the overarching guidelines of which must be provided by appropriate political regulation, ethical use of technology and sufficient public awareness of sustainable and digital challenges and opportunities. In this process, we must not overlook the role and importance of everyone as a member of society,

who, by meaningfully adjusting their lifestyle and using digitalisation wisely, can significantly contribute to the wellbeing of global society, regardless of potentially limited knowledge about digitalisation and sustainability.

Lifelong learning is key to personal and social development in a rapidly changing society. Continuous knowledge acquisition is becoming necessary as the world is constantly changing. In this context, lifelong learning is decisive for the adaptability and competitiveness of individuals and organisations. The transition to a sustainable development paradigm of the future also requires lifelong learning, as it equips individuals with the knowledge and skills necessary to solve global challenges, such as climate change, resource scarcity, desertification, deforestation, regrowth, healthy lifestyles, sustainable mobility, circular economy, social responsibility, etc. Since this knowledge was neither relevant nor taught in the past or did not even exist to the extent it does today, it is all the more important that generations that have already completed formal education are also educated. These generations are in leading positions in companies and organisations, holding senior positions as executives, logistics and supply chain managers, and therefore having the power to make decisions that will have far-reaching consequences. This is why they need a modern perspective on the present and future challenges. Even employees, who are generally less involved in education than managerial staff, are affected by changes and the need for measures supporting sustainable development paradigm. If they do not acquire the necessary knowledge and do not include it in the educational process, the transition to a carbon-free future and more responsible behaviour of companies, organisations and individuals would be significantly less successful and more time-consuming, perhaps even unfeasible.

Engaging in lifelong learning brings many benefits, including personal and professional development, adaptability in a changing world, and cognitive, social, and psychological benefits. A society that promotes lifelong learning is better prepared for future challenges and more successful, as it remains skilled, adaptable, and sustainably oriented.

Traditional higher education institutions are also adapting to lifelong learning trends and offering a wide range of courses, workshops, training, etc., that enable practical education and the acquisition of new competencies. Commercial providers play an additional role. They play a key role in providing up-to-date and tailored courses focused on practical skills directly related to industry, allowing participants to acquire

applicable knowledge. Certification, standardisation, and regulatory bodies also contribute to lifelong learning by offering specialised courses and certificates in various fields. However, universities and traditional higher education institutions are expected to open up more in the future and develop new content and methods for lifelong learning, as the so-called micro-evidence system will require accredited education. However, it is first necessary to define precisely what this knowledge is and where the gaps need to be filled with micro-evidence. This scientific monograph contributes to this endeavour.

In the digital age, lifelong learning is more accessible than ever, with online platforms such as massive open online courses (MOOCs) are expanding. These platforms allow individuals to access high-quality education from various institutions, democratise education and offer personalised learning experiences that meet individual needs. In addition, open educational resources (OER) are also available, which provide free access to educational content. Digitalisation has long ceased to be just a "buzzword" but has become the new normal in education, the economy, and public administration. Rapid access to data from any corner of the world and its automatic processing are increasingly achievable. Automatic processing, decision-making, and task performance by machines enable more efficient use of resources and fill the gap in labour shortages, especially in unskilled occupations.

On the other hand, the creation of vast amounts of digitised data is becoming an ever more significant challenge from both a human and environmental perspective. From a human perspective, questions arise about how to extract the correct data and not be influenced by the algorithms of digital technologies but rather be independent. To what extent can the advantages of digital technologies be integrated into one's life without excessive adverse effects on psychosocial risk factors? The digitalisation of the educational process, as more and more experts are finding, is not recommended for primary education, but only in a later, more mature period. On the other hand, from the perspective of the rational use of natural resources, the question arises about where to obtain and how to produce sufficient quantities of microprocessors, batteries, circuits, and conductors, how to generate the power needed, and what to do with all the materials and products at the end of their initial lifespan? As already mentioned, the "cloud" also needs physical resources, energy and space.

We can argue that lifelong learning is the key to successful adaptation in a rapidly changing world, be it on a personal, professional or social level. Knowledge empowers us to create a more sustainable development paradigm. Digital technologies and various educational resources provide us with access to the knowledge and skills necessary for successful advancement in the professional sphere and modern society. Their use must be responsible and thoughtful, as too fast or wrongly directed and unregulated development can sometimes bring unpredictable consequences, not only in logistics 5.0 but in the entire 5.0 society. Darwin already claimed that the most adaptable survive, but it is necessary to know that even exceptional human adaptability is limited.

The monograph's research part brings the research results related to three different areas of society's operation: legislation, the higher education system in Slovenia, and the business sector in logistics and supply chains. We must view the processes and surroundings of a company as a whole and consider this fact when transitioning to a sustainable way of doing business. The concept of the EU taxonomy, which advocates the principle of "Do-no-harm," must also not be overlooked, as individual projects are often highlighted only as advantages, while potential harm is hidden. On the other hand, the higher education study programmes presented in Slovenia show a moderate representation of sustainable development content, especially the contents in the fields of the circular economy and sustainable development, two of the EU priorities. The analysis focused on logistics study programmes shows that digital content statistically significantly dominates curricula compared to sustainable content. In logistics study programmes, there are twice as many learning units with integrated digitalisation as there are those with integrated sustainable development content, while 9% of learning units combine both sustainable development and digitalisation content. The data is encouraging and indicates opportunities for further focus on the development of learning units that integrate sustainable development and digitalisation content, while also enhancing the incorporation of sustainability topics into existing units. The main finding of the results of the empirical research conducted in the business sector in the field of logistics among students of logistics and logistics academics shows a generally positive perception of the further development of sustainable, digital and transversal skills. All target groups included in the empirical research highlight the increased relevance of the aforementioned skills in the period of five years. It is also encouraging that for the statements/skills for which statistically significant differences were found (the importance of all skills was mostly rated highest by employees in the logistics and supply chain business

sector), there is additional confirmation of the importance of these skills and a smooth flow of knowledge from higher education institutions to the economy.

Based on the given ESD guidelines and the previously presented challenges in logistics and supply chains, the long-term goal should be to develop a system that will enable the achievement of measurably higher competencies essential for the green and digital transition. The framework for establishing this system is represented by examples of good practice and lifelong learning guidelines that will enable the acquisition of micro-evidence in green and digital logistics and supply chains. The purpose of offering such forms of lifelong learning is to simultaneously address a more significant number of previously mentioned and previously limited target groups, namely students, graduates from the past, and employees in public and private sector organisations, such as public administration, logistics and other companies that carry out logistics activities, and all other interested stakeholders. From a didactic perspective, the future directions include the use of digital tools, the integration of traditional and online education, flexibility and adaptability in the delivery of individual trainings, and clear and continuous assessment of learning outcomes.

Based on research and analysis of competency models, we have identified four key areas of work: (1) sustainability management in logistics, (2) digital transformation in logistics, (3) resilience in supply chains, and (4) interdisciplinary and applied logistics knowledge. Within the area of (1) sustainability management in logistics, we highlight current knowledge in the field of environmental assessment through LCA, carbon footprint reduction, the focus on sustainable energy self-sufficiency, understanding the causes and consequences of climate change, the circular economy, social responsibility, and sustainable business practices. The area of (2) digital transformation in logistics covers a broader range of knowledge relating to the planning and implementation of business digitalisation, automation and robotisation of business processes, business information systems, decision-making using simulations, etc. The area of (3) resilience in supply chains should include current knowledge in the field of supply chain design strategies and the detection of potential disruptions and adaptation to them, efficient product distribution, the specifics of sustainable urban logistics and mobility, the search for sustainable sources, ergonomics in the workplace, and lean processes with an emphasis on value chains, etc. Within the area of (4) interdisciplinary and applied logistics knowledge, we propose the inclusion of current knowledge in the field of data-based business

decision-making, the sustainable aspect of travel organisation and implementation, information and computer literacy, etc. Area 4, therefore, fills the gap between logistics-specific knowledge and the knowledge that enables us to operate more sustainably in everyday life. The listed areas were created based on the results of research presented in this scientific monograph and close cooperation with the labour market in the field of logistics and supply chains and in accordance with   the main lifelong learning models, which are reflected in the offer of current educational programmes tailored to the diverse needs of the identified target groups.

KNOWLEDGE SUPPLY CHAINS:
ENHANCING WISDOM OF GREEN AND DIGITAL TRANSITION
M. Obrecht et al.

University of Maribor Press

References

10 Sustainability Trends to Watch in 2022. (2021, July 29). WatchWire.
    https://watchwire.ai/sustainability-trends-2022/

About DOAJ. (n.d.). DOAJ Open Global Trusted. Retrieved 27 September 2023, from
    https://doaj.org/about/

About Earth Overshoot Day. (n.d.). *Earth Overshoot Day.* Retrieved 7 December 2023, from
    https://overshoot.footprintnetwork.org/about-earth-overshoot-day/

About Khan Academy. (n.d.). Khan Academy. Retrieved 27 September 2023, from
    https://www.khanacademy.org/about

Aho Williamson, D. (2022, September 16). *Digital Trust Benchmark 2022.* Insider Intelligence.
    https://www.insiderintelligence.com/content/digital-trust-benchmark-2022

Aleandri, G., & Refrigeri, L. (2013). Lifelong Learning, Training and Education in Globalized
    Economic Systems: Analysis and Perspectives. *Procedia - Social and Behavioural Sciences*, *93*,
    1242–1248. https://doi.org/10.1016/j.sbspro.2013.10.022

Anderson, M., A. Vogels, E., Perrin, A., & Rainie, L. (2022, November 16). Connection, Creativity
    and Drama: Teen Life on Social Media in 2022. *Pew Research Center: Internet, Science & Tech.*
    https://www.pewresearch.org/internet/2022/11/16/connection-creativity-and-drama-teen-
    life-on-social-media-in-2022/

Anderson, M., & Jiang, J. (2018, November 28). Teens and their experiences on social media. *Pew
    Research Center: Internet, Science & Tech.*
    https://www.pewresearch.org/internet/2018/11/28/teens-and-their-experiences-on-social-
    media/

Anielski, M. (2022, October 12). *Economy of Well-Being and Regenerative Growth in Slovenia, Europe, World.*
    https://www.um.si/wp-content/uploads/2022/10/Builiding-Economies-of-Well-being-for-
    Slovenia-Europe-Anielski-Oct-12th-Maribor-Sept-30th-2.pdf

Anko, B. (1992). *Skrb za Zemljo: Strategija za življenje po načelu trajnosti : povzetek* (2. nat). Aram.

Anko, B., Bogataj, N., & Mastnak, M. (2009). *Berilo o trajnosti.* Andragoški center Slovenije.
    https://plus.cobiss.net/cobiss/si/sl/bib/sikvel-1/248812800

Application of the EU Taxonomy for Companies. (n.d.). EU Taxonomie Info. Retrieved 3 December 2022,
    from https://eu-taxonomy.info/info/eu-taxonomy-for-companies

Armano, D. (2009, November 2). Six Social Media Trends for 2010. *Harvard Business Review.*
    https://hbr.org/2009/11/six-social-media-trends

Arnold, A. (2018, April 4). Are We Entering The Era Of Social Shopping? *Forbes.*
    https://www.forbes.com/sites/andrewarnold/2018/04/04/are-we-entering-the-era-of-
    social-shopping/

Ashraf, Q., & Galor, O. (2008). Malthusian Population Dynamics: Theory and Evidence. *Working
    Papers*, *6*, Article 2008–6. https://ideas.repec.org//p/bro/econwp/2008-6.html

Bec, D., Ciglenečki, D., Dolšak Lavrič, P., Gjerek, M., Koleša, T., Logar, M., Matavž, L., Murovec,
    M., Rus, M., & Žabkar, R. (2022). *Kakovost zraka v Sloveniji v letu 2021* (p. 194). Ministrstvo za
    okolje in prostor, Agencija Republike Slovenije za okolje.
    https://podatki.gov.si/dataset/merilna-mesta-za-meritve-kakovosti-zunanjega-zraka-in-
    padavin/resource/24cce760-8ca7-4989-9865-d51f5d8dd528

Bianchi, G., Pisiotis, U., & Cabrera, C. (2022). *GreenComp, the European sustainability competence framework* (Y. Punie & M. Bacigalupo, Eds.). Publications Office of the European Union. https://data.europa.eu/doi/10.2760/13286

Biljman, T. (2023, May 25). *Social Media Trends That You Need To Pay Attention To in 2023*. https://www.sendible.com/insights/latest-social-media-trends-report

Blackburn, W. R. (2007). *The Sustainability Handbook: The Complete Management Guide to Achieving Social, Economic, and Environmental Responsibility*. Environmental Law Institute.

B.R. (2021, October 15). *Je že skrajni čas za bolj trajnostna oblačila?* Dominvrt.Si. https://www.dominvrt.si/okolje/ekologija/oblacila-trajnost.html

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/38842

ChatGPT. (2023). https://chat.openai.com

Chiţiba, C. A. (2012). Lifelong Learning Challenges and Opportunities for Traditional Universities. *Procedia - Social and Behavioural Sciences*, *46*, 1943–1947. https://doi.org/10.1016/j.sbspro.2012.05.408

Climate Change. (n.d.). Retrieved 8 September 2023, from https://www.carboncare.org/en/climate-change

Cojoianu, T. F., Hoepner, A. G. F., & Vu, A. (2022, November). *A Comparison Between the EU Green Taxonomy and South Africa's Green Taxonomy*. https://www.treasury.gov.za/comm_media/press/2022/2022111101%20Report_A%20Comparison%20Between%20the%20EU%20Green%20Taxonomy%20and%20South%20Africa%E2%80%99s%20Green%20Taxonomy.pdf

Commission of the European Communities. (2001, November 21). *COMMUNICATION FROM THE COMMISSION: Making a European Area of Lifelong Learning a Reality*. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2001:0678:FIN:EN:PDF

Continuing professional development. (2023, January 2). Chalmers. https://www.chalmers.se/en/education/programmes-and-courses/continuing-professional-development/

Costa, C., Wollenberg, E., Benitez, M., Newman, R., Gardner, N., & Bellone, F. (2022). Roadmap for achieving net-zero emissions in global food systems by 2050. *Scientific Reports*, *12*(1), Article 1. https://doi.org/10.1038/s41598-022-18601-1

Coursera. (n.d.). Coursera. Retrieved 27 September 2023, from https://www.coursera.org/

Courses and Certifications. (n.d.). Coursera. Retrieved 27 September 2023, from https://www.coursera.org/courses

Courses at Wroclaw University of Economics. (n.d.). Retrieved 27 September 2023, from https://industry.stanversity.com/#courses

Cvahte Ojsteršek, T., & Topolšek, D. (2023a). *Kako distribuirati produkte? O optimalni in trajnostni distribucijski strategiji*. NOO Projekt. https://www.digingreen.org/prakti-ni-primeri-digitalizacije-podjetj

Cvahte Ojsteršek, T., & Topolšek, D. (2023b). *Mestna logistika—Zapleten, a obvladljiv sistem*. NOO Projekt. https://www.digingreen.org/vitka-in-agilna-logistika

D'Alisa, G., Demaria, F., & Kallis, G. (Eds.). (2019). *Odrast: Besednjak za novo dobo*. Studia humanitatis. https://plus.cobiss.net/cobiss/um/sl/bib/epf/299060480

Daugul, L. (2020, November 27). *Odrast – postopen odmik od trajne gospodarske rasti, ki izčrpava planet—Intervju z Dušanom Plutom*. rtvslo.si. https://www.rtvslo.si/okolje/zeleni-petek/odrast-postopen-odmik-od-trajne-gospodarske-rasti-ki-izcrpava-planet/539590

De Abreu, E. (2015, December 29). *9 Hottest Social Media Trends From 2015*. Overdrive Interactive. https://www.ovrdrv.com/blog/9-hottest-social-media-trends-from-2015/

Definition of SOCIAL MEDIA. (2023, March 7). Merriam-Webster. https://www.merriam-webster.com/dictionary/social+media

Denac, M. (2023). *Okoljska presoja LCA*. NOO Projekt. https://www.digingreen.org/okoljska-presoja-lca

Dixon, S. (2023, January 25). *Europe social media users by platform 2027*. Statista.
    https://www.statista.com/forecasts/1334334/social-media-users-europe-by-platform

Dorsett, R., Lui, S., & Weale, M. (2010). Economic Benefits of Lifelong Learning. *National Institute of
    Economic and Social Research, NIESR Discussion Papers.*

Državni zbor. (2021, July 13). *Resolucija o Dolgoročni podnebni strategiji Slovenije do leta 2050 (ReDPS50).*
    http://pisrs.si

Dunajska konvencija o varstvu ozonskega plašča. (2019, December 12). https://eur-lex.europa.eu/legal-
    content/SL/TXT/HTML/?uri=LEGISSUM:4413654

ECDL programi. (n.d.). ECDL. Retrieved 27 September 2023, from
    https://www.ecdl.si/program/ECDL-osnovni-tecaj

edX Courses. (n.d.). edX. Retrieved 27 September 2023, from https://www.edx.org/search

Ekart, J. (2023, May 25). *Sončne elektrarne v Sloveniji—Pregled trga.* https://www.varcevanje-
    energije.si/fotovoltaicne-elektrarne/soncne-elektrarne-pregled-trga-v-sloveniji.html

Ekkehard, P., Hametner, M., Kostetckaia, M., Patki, P., Best, A., Bueb, B., Knoblauch, D.,
    Landgrebe, R., Scholl, L., Stein, U., Velten, E. K., De Rocchi, A., Kohli, A., Petry, C.,
    Shatrov, K., & Steinemann, M. (Eds.). (2023). *Sustainable Development in the European Union –
    2023: Monitoring Report on Progress Towards the SDGs in an EU Context* (7th ed.). Publications
    Office of the European Union. https://doi.org/10.2785/403194

Ekonomija blaginje. (n.d.). Fran.si. Retrieved 26 September 2023, from
    https://fran.si/iskanje?View=1&Query=ekonomija+blaginje+

Ekonomija delitve. (n.d.). Fran.si. Retrieved 26 September 2023, from
    https://www.fran.si/iskanje?All=deljeno%20ekonomija&IsAdvanced=True

ELA Qualification Standards. (n.d.). *European Logistics Association.* Retrieved 8 September 2023, from
    https://www.elalog.eu/ela-standards/

EU Taxonomy Overview. (n.d.). EU Taxonomie Info. Retrieved 26 September 2023, from https://eu-
    taxonomy.info/info/eu-taxonomy-overview

EU Taxonomy Timeline. (n.d.). EU Taxonomie Info. Retrieved 26 September 2023, from https://eu-
    taxonomy.info/info/eu-taxonomy-timeline

European Environment Agency. (2023a, August 3). *Število prezgodnjih smrti zaradi onesnaženosti zraka v
    EU še naprej upada, toda kljub temu so potrebna dodatna prizadevanja za vzpostavitev okolja brez strupov*
    [Novice]. https://www.eea.europa.eu/sl/highlights/stevilo-prezgodnjih-smrti-zaradi-
    onesnazenosti

European Environment Agency. (2023b, October 6). *Economic losses from weather- and climate-related
    extremes in Europe.* https://www.eea.europa.eu/en/analysis/indicators/economic-losses-from-
    climate-related

European Parliament. (n.d.). European Parliament. Retrieved 26 September 2023, from
    https://www.europarl.europa.eu/portal

Eurostat. (2023a). *Waste statistics 2020.* https://ec.europa.eu/eurostat/statistics-
    explained/index.php?title=Waste_statistics

Eurostat. (2023b, January). *Renewable energy statistics.* https://ec.europa.eu/eurostat/statistics-
    explained/index.php?title=Renewable_energy_statistics

Eurostat. (2023c, January 24). *Circular material use rate.*
    https://ec.europa.eu/eurostat/databrowser/view/ENV_AC_CUR__custom_4076930/book
    mark/table?lang=en&bookmarkId=599a35d5-be3c-44d6-8896-62e00d9b6e49

Eurostat. (2023d, July 19). *Share of renewable energy in gross final energy consumption by sector.*
    https://ec.europa.eu/eurostat/databrowser/view/sdg_07_40/default/bar?lang=en

Evropska komisija. (2019, December 11). *Evropski zeleni dogovor.* Evropska komisija. https://eur-
    lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-
    01aa75ed71a1.0015.02/DOC_1&format=PDF

Evropska komisija. (2023, September 20). *Biodiversity strategy for 2030.*
    https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en

Evropski parlament. (2023, May 24). *Krožno gospodarstvo: Definicija, pomen in prednosti.*
    https://www.europarl.europa.eu/news/sl/headlines/economy/20151201STO05603/krozno
    -gospodarstvo-definicija-pomen-in-prednosti

Evropski svet. (2021, April 12). *Ekonomija dobrega počutja: Več kot zgolj BDP.*
    https://www.consilium.europa.eu/sl/infographics/economy-wellbeing/

Field, J. (2006). Lifelong learning and the new educational order. *British Journal of Educational Technology*,
    37(6), 987–988. https://doi.org/10.1111/j.1467-8535.2006.00660_18.x

Fleck, A. (2022, July 11). *Infographic: Recycling Efforts Not Enough to Solve Plastic Waste Problem.* Statista
    Daily Data. https://www.statista.com/chart/27756/global-waste-management-projections

Fleming, S. (2019, April 3). *Here's how the United States is falling in love with secondhand clothes.*
    https://www.weforum.org/agenda/2019/04/united-states-loves-secondhand-clothes/

FutureLearn. (n.d.). *Short Online Courses.* FutureLearn. Retrieved 27 September 2023, from
    https://www.futurelearn.com/courses

Gajšek, B., & Šinko, S. (2023). *Oblikovanje hibridnih delovnih mest.* NOO Projekt.
    https://www.digingreen.org/trajnostna-prehranska-ov

Gansky, L. (2010). *The Mesh: Why the Future of Business Is Sharing.* Penguin Group.
    https://informationdj.files.wordpress.com/2012/01/future-of-business-is-lisa-gansky.pdf

Gazan, R., Maillot, M., Reboul, E., & Darmon, N. (2021). Pulses Twice a Week in Replacement of
    Meat Modestly Increases Diet Sustainability. *Nutrients*, *13*(9), Article 9.
    https://doi.org/10.3390/nu13093059

Geografski atlas naravnih nesreč v Sloveniji (GANNS). (n.d.). Retrieved 19 November 2023, from
    https://experience.arcgis.com/experience/4f4b94a5e32241068bd3b837c9c26d70/

Gill, G. (2022, October 13). *Sustainability trends 2023: 7 ways retailers will make a difference.* The Future of
    Commerce. https://www.the-future-of-commerce.com/2022/10/13/sustainability-trends-
    2023/

Global daily social media usage 2022. (n.d.). Statista. Retrieved 31 March 2023, from
    https://www.statista.com/statistics/433871/daily-social-media-usage-worldwide/

Global meat consumption, World, 1961 to 2050. (n.d.). Our World in Data. Retrieved 26 September 2023,
    from https://ourworldindata.org/grapher/global-meat-projections-to-2050

Global retail e-commerce sales 2026. (n.d.). Statista. Retrieved 31 March 2023, from
    https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/

Global social media usage reasons 2022. (n.d.). Statista. Retrieved 10 July 2023, from
    https://www.statista.com/statistics/715449/social-media-usage-reasons-worldwide/

Gondjia, G., & Merle, C. (2021, July 29). *Sustainable Taxonomy development worldwide: A standard-setting
    race between competing jurisdictions.* https://gsh.cib.natixis.com/our-center-of-
    expertise/articles/sustainable-taxonomy-development-worldwide-a-standard-setting-race-
    between-competing-jurisdictions

Gostiša, N. (2022, April 6). *Registrirana cestna motorna vozila in prikolice, 2021.* Stat.Si.
    https://www.stat.si/StatWeb/News/Index/10178

Gow, G. (2020, October 21). *Environmental Sustainability And AI.* Forbes.
    https://www.forbes.com/sites/glenngow/2020/08/21/environmental-sustainability-and-ai/

Helne, T., & Hirvilammi, T. (2015). Wellbeing and Sustainability: A Relational Approach. *Sustainable
    Development*, *23*(3), 167–175. https://doi.org/10.1002/sd.1581

Hollands, F., & Tirthali, D. (2014). MOOCs: Expectations and reality. *Center for Benefit-Cost Studies of
    Education, Teachers College, Columbia University, New York, NY.*

Ibrahim, Y., Hami, N., & Abdulameer, S. (2020). A Scale for Measuring Sustainable Manufacturing
    Practices and Sustainability Performance: Validity and Reliability. *Quality Innovation Prosperity*,
    24, 59–74. https://doi.org/10.12776/QIP.V24I2.1385

IEA. (2021, October 22). *Cumulative emissions reduction by mitigation measure in the Net Zero Scenario, 2021-
    2050 – Charts – Data & Statistics.* IEA. https://www.iea.org/data-and-
    statistics/charts/cumulative-emissions-reduction-by-mitigation-measure-in-the-net-zero-
    scenario-2021-2050

Intergovernmental Panel on Climate Change (IPPC). (2022). Annex I: Glossary. In *Global Warming of
    1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-industrial Levels in
    Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate
    Poverty* (pp. 541–562). Cambridge University Press.
    https://doi.org/10.1017/9781009157940.008

IPCC. (2023). *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (First, p. 184). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

Issberner, L.-R., & Léna, P. (2018, March 27). *Anthropocene: The vital challenges of a scientific debate.* UNESCO. https://en.unesco.org/courier/2018-2/anthropocene-vital-challenges-scientific-debate

Jandrić, M., & Ranđelović, S. (2018). Adaptability of the workforce in Europe – changing skills in the digital era. *Zbornik Radova Ekonomskog Fakulteta u Rijeci : Časopis Za Ekonomsku Teoriju i Praksu*, *36*(2), 757–776. https://doi.org/10.18045/zbefri.2018.2.757

Jereb, B. (2023a). *Digitalizacija poslovanja—Izvajanje*. NOO Projekt. https://www.digingreen.org/digitalizacija-poslovanja-izvedba

Jereb, B. (2023b). *Digitalizacija poslovanja—Načrtovanje*. NOO Projekt. https://www.digingreen.org/digitalizacija-poslovanja-na-rtovanje

Joint Research Centre. (2022, June 29). *The twin green & digital transition: How sustainable digital technologies could enable a carbon-neutral EU by 2050*. https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/twin-green-digital-transition-how-sustainable-digital-technologies-could-enable-carbon-neutral-eu-2022-06-29_en

Kajba, M. (2023). *Informacijska in računalniška varnost*. NOO Projekt. https://www.digingreen.org/informacijska-pismenost-in-varnost

Karba, R., Tkalec, T., Peterlin, M., & Šifkovič Vrbica, S. (2016, June 20). *Vodnik Dovolj za vse – skupnostno upravljanje z življenjskimi viri* (R. Karba, Ed.). https://sloga-platform.org/vodnik-dovolj-za-vse-skupnostno-upravljanje-z-zivljenjskimi-viri/

Katalog študijskih programov in učnih enot. (n.d.). AIPS, Univerza v Mariboru. Retrieved 27 September 2023, from https://aips.um.si/PredmetiBP5/main.asp

Kazalniki ciljev trajnostnega razvoja. (n.d.). Republika Slovenija Statistični Urad. Retrieved 8 September 2023, from https://www.stat.si/Pages/cilji

Kebe, N., & Stare, M. (2023, March 14). *Splošno zadovoljstvo s finančnim stanjem in dolžino prostega časa večje, z medosebnimi odnosi na enaki ravni.* https://www.stat.si/StatWeb/News/Index/10985

Kjell, O. N. E. (2011). Sustainable well-being: A potential synergy between sustainability and well-being research. *Review of General Psychology*, *15*(3), 255–266. https://doi.org/10.1037/a0024603

Knez, M. (2023). *Faze trajnostnega delovanja organizacije*. NOO Projekt. https://www.digingreen.org/stopnje-ozelenitve-podjetja

Kralj, R. (2023, September 25). *Svet pada s tečajev*. Za-Misli Kolumna. https://za-misli.si/kolumne/rok-kralj/

Kramar, U. (2023a). *Logistika skozi igro/nabava*. Noo Projekt. https://www.digingreen.org/logistika-skozi-igro

Kramar, U. (2023b). *Vpliv nabavne funkcije na večjo odpornost*. NOO Projekt. https://www.digingreen.org/nabava-za-ve-jo-odpornost

Kühne Logistics University. (n.d.). *Certificate program ENLOP*. Kühne Logistics University. Retrieved 27 September 2023, from https://www.klu.org/executive-education/open-enrollment-seminars/certificate-program-enlop, https://www.klu.org/executive-education/open-enrollment-seminars/certificate-program-enlop

Lambert, J. (2022, November 21). *15 Sustainable Business Trends that will Shape the Future*. Informi. https://informi.co.uk/blog/15-sustainable-business-trends-that-will-shape-the-future

Landrigan, P. J., Fisher, S., Kenny, M. E., Gedeon, B., Bryan, L., Mu, J., & Bellinger, D. (2022). A replicable strategy for mapping air pollution's community-level health impacts and catalyzing prevention. *Environmental Health*, *21*(1), 70. https://doi.org/10.1186/s12940-022-00879-3

Lazar, S., Klimecka-Tatar, D., & Obrecht, M. (2021). Sustainability Orientation and Focus in Logistics and Supply Chains. *Sustainability*, *13*(6), Article 6. https://doi.org/10.3390/su13063280

Laznik, M., & Žitnik, M. (2023, March 2). *Kazalniki krožnega gospodarstva, 2021*. Statistični Urad RS. https://www.stat.si/StatWeb/News/Index/10967

Lehdonvirta, V. (2012). *A history of the digitalisation of consumer culture: From Amazon through Pirate Bay to FarmVille*. 30.

Lexica AI - TeamSmart AI. (n.d.). Retrieved 12 July 2023, from https://www.teamsmart.ai

Lock, S. (2022, December 5). What is AI chatbot phenomenon ChatGPT and could it replace humans? *The Guardian*. https://www.theguardian.com/technology/2022/dec/05/what-is-ai-chatbot-phenomenon-chatgpt-and-could-it-replace-humans

López, B., Rangel-Pérez, C., & Fernández, M. (2023). Sustainable strategies in the luxury business to increase efficiency in reducing carbon footprint. *Journal of Business Research*, *157*, 113607. https://doi.org/10.1016/j.jbusres.2022.113607

Lozar, J. (2018). *Zavedanje, stališča in vedenje slovenskih porabnikov v delitveni ekonomiji* [Magistrsko delo, Univerza v Ljubljani, Ekonomska fakulteta]. https://repozitorij.uni-lj.si/IzpisGradiva.php?id=105696

Macarol, V. (2022, June 18). 5 nasvetov za nakup trajnostne mode: Nakupovanje s čim manjšim vplivom na okolje. *City Magazine*. https://citymagazine.si/5-nasvetov-za-nakup-trajnostne-mode/

Marcen, B. (2023). *Informacijska in računalniška pismenost*. NOO Projekt. https://www.digingreen.org/video-delavnica

Mckay, B. (2023, August 17). *Global Sustainability Trends for 2023—According to 42 experts!* GreenMatch.Co.Uk. https://www.greenmatch.co.uk/blog/sustainability-trends

Media influence on pre-teens and teenagers: Social media, movies, YouTube and apps. (n.d.). Raising Children Network. Retrieved 12 July 2023, from https://raisingchildren.net.au/pre-teens/entertainment-technology/media/media-influence-on-teens

Ministrstvo za okolje, podnebje in energijo. (2023, June 6). *Ravnanje z odpadki*. Portal GOV.SI. https://www.gov.si/teme/ravnanje-z-odpadki/

Ministrstvo za vzgojo in izobraževanje. (n.d.). *Evidenca visokošolskih zavodov in študijskih programov*. ePortal MMS. Retrieved 29 September 2023, from https://eportal.mss.edus.si/portal/evs-evidenca-visokosolskih-zavodov-in-studijskih-programov

MIT Open Learning Library. (n.d.). MIT OpenCourseWare. Retrieved 27 September 2023, from https://ocw.mit.edu/collections/mit-open-learning-library/

Moth, D. (2015, December 9). *What were the most significant social media trends in 2015?* Econsultancy. https://econsultancy.com/what-were-the-most-significant-social-media-trends-in-2015/

Number of worldwide social network users 2027. (n.d.). Statista. Retrieved 31 March 2023, from https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/

Obrecht, M. (2023a). *5 korakov za oblikovanje oskrbovalne verige*. NOO Projekt. https://www.digingreen.org/5-korakov-do-strategie-ov

Obrecht, M. (2023b). *Energetska samooskrba*. NOO Projekt. https://www.digingreen.org/kro-no-gospodarstvo

Obrecht, M. (2023c). *Kako izkoristiti motnje za kreiranje odpornih oskrbovalnih verig*. NOO Projekt. https://www.digingreen.org/avtomatizacija-in-robotizacija

Obrecht, M., & Denac, M. (2023). *Okoljska presoja: Kako zmanjšati svoj okoljski odtis?* NOO Projekt. https://www.digingreen.org/okoljska-presoja-in-ekolo-ki-in-oglji-ni

Obrecht, M., Feodorova, Z., & Rosi, M. (2022). Assessment of environmental sustainability integration into higher education for future experts and leaders. *Journal of Environmental Management*, *316*, 115223. https://doi.org/10.1016/j.jenvman.2022.115223

Obrecht, M., & Knez, M. (2023). *Do okoljsko vzdržnega izdelka z ekodizajno*. NOO Projekt. https://www.digingreen.org/ekodizajn

Odrast. (n.d.). Fran.si. Retrieved 26 September 2023, from https://fran.si/132/sprotni-sprotni-slovar-slovenskega-jezika/4571637/odrast?View=1&Query=odrast

OER Commons. (n.d.). OER Commons. Retrieved 27 September 2023, from https://oercommons.org/

Okorn, B. (2020, September 9). *Z majhnimi koraki do velikega učinka—Trajnostna raba tehničnih in drugih izdelkov za dom*. ZPS. https://www.zps.si/nasveti-in-vodniki/z-majhnimi-koraki-do-velikega-ucinka-trajnostna-raba-tehnicnih-in-drugih-izdelkov-za-dom-2020-09-09

Open University. (n.d.). Tampere Universities. Retrieved 27 September 2023, from
https://www.tuni.fi/en/study-with-us/open-higher-education-studies/open-university

Oxfam Germany e.V., & European Environmental Bureau. (2021, April 21). *Towards a wellbeing economy that serves people and nature: Building a human environment that is socially just and ecologically.* https://www.climateofchange.info/wellbeingeconomyreport.pdf

Pardes, A. (n.d.). The Complete History of Emoji. *Wired*. Retrieved 31 March 2023, from
https://www.wired.com/story/guide-emoji/

Pariški sporazum, L. 282/43, 15 (2016).

Park, J. H., Lee, K., & Dabelko-Schoeny, H. (2016). A Comprehensive Evaluation of a Lifelong Learning Program: Program 60. *The International Journal of Aging and Human Development*, *84*(1), 88–106. https://doi.org/10.1177/0091415016668352

Patel, D. (2019, December 20). *12 Social Media Trends to Watch in 2020*. Entrepreneur.
https://www.entrepreneur.com/science-technology/12-social-media-trends-to-watch-in-2020/343863

Pavić, L. (2023). *Osnove poslovnega odločanja na podlagi podatkov*. NOO Projekt.
https://www.digingreen.org/data-based-decision

Pavić, L., & Cvahte Ojsteršek, T. (2023). *Z zelenim kovčkom na pot*. NOO Projekt.
https://www.digingreen.org/z-zelenim-kov-kom-na-pot

Petronzi, D., & Hadi, S. M. (2016). Exploring the Factors Associated with MOOC Engagement, Retention and the Wider Benefits for Learners. *European Journal of Open, Distance and E-Learning*, *19*(2), 129–146. https://doi.org/10.1515/eurodl-2016-0011

Pistotnik, A. (2018). Uvod v odrast: Dobrodošli na prehodu v svetlo 21. Stoletje odrasti. *Časopis za kritiko znanosti, domišljijo in novo antropologijo*, 7–15.

Plant-based meat for a growing world. (2019). Good Food Institute.
https://gfi.org/resource/environmental-impact-of-meat-vs-plant-based-meat/

Program izobraževanj SIQ. (n.d.). SIQ. Retrieved 27 September 2023, from
https://www.siq.si/izobrazevanje/program/

Quoquab, F., Mohammad, J., & Sukari, N. N. (2019). A multiple-item scale for measuring "sustainable consumption behaviour" construct: Development and psychometric evaluation. *Asia Pacific Journal of Marketing and Logistics*, *31*(4), 791–816. https://doi.org/10.1108/APJML-02-2018-0047

Rafferty, J. P. (2023). Anthropocene Epoch. In *Encyclopedia Britannica*.
https://www.britannica.com/science/Anthropocene-Epoch

Richter, F. (2022, May 24). *Remote work in the U.S.: The Great Return*. Statista Daily Data.
https://www.statista.com/chart/27516/employees-working-remotely-due-to-coronavirus

Richter, F. (2023, July 24). *Electric Mobility: Norway Leads the Charge*. Statista Daily Data.
https://www.statista.com/chart/17344/electric-vehicle-share

Roper, W. (2020, December 16). *Remote work in the U.S.: Remote Work Could Double Permanently*. Statista Daily Data. https://www.statista.com/chart/23781/remote-work-teams-departments

Rosenwald, M. S. (2021, October 28). Before Twitter and Facebook, there was Morse code: Remembering social media's true inventor. *Washington Post*.
https://www.washingtonpost.com/news/retropolis/wp/2017/05/24/before-there-was-twitter-there-was-morse-code-remembering-social-medias-true-inventor/

Rupnik, B. (2023a). *Podpora odločanja s simulacijami*. NOO Projekt. https://www.digingreen.org/flexsim

Rupnik, B. (2023b). *Poslovni informacijski sistemi*. NOO Projekt.
https://www.digingreen.org/informacijski-sistemi-sap-erp

Rutar, T., Božič, T., & Deželak, K. (2021, October 6). *Končna raba energije je bila v letu 2020 za 9 % manjša kot v 2019*. https://www.stat.si/StatWeb/news/Index/9884

Shah, S. (2016, May 14). *The History of Social Media*. Digital Trends.
https://www.digitaltrends.com/computing/the-history-of-social-networking/

Simone, P. M., & Sciulli, M. (2006). Cognitive benefits of participation in lifelong learning institutes. *LLI Review*, *1*, 44–51.

Simplilearn. (2023, July 4). *Top 7 Impacts of Social Media: Advantages and Disadvantages | Simplilearn*. Simplilearn.Com. https://www.simplilearn.com/real-impact-social-media-article

SiStat. (n.d.-a). *Osebni avtomobili, avtobusi in tovorna vozila konec leta (31. 12.) ter prve registracije teh vozil po vrsti vozila, pogona in goriva, Slovenija, letno*. Stat.Si. Retrieved 7 February 2023, from https://pxweb.stat.si:443/SiStatDataSiStatData/pxweb/sl/Data/Data/2222109S.px/

SiStat. (n.d.-b). *Podjetja po dejavnosti (SKD 2008) in velikosti glede na število oseb, ki delajo, Slovenija, letno*. PX-Web. Retrieved 3 December 2022, from https://pxweb.stat.si:443/SiStatDataSiStatData/pxweb/sl/Data/-/1418801S.px/

Six Sustainability Trends to Watch in 2022. (2022, June 4). *Earth5R*. https://earth5r.org/six-sustainability-trends-to-watch-in-2022/

Slacktivism. (2023). In *Cambridge Dictionary*. https://dictionary.cambridge.org/dictionary/english/slacktivism

Social Media Advertising—Europe. (n.d.). Statista. Retrieved 18 May 2023, from https://www.statista.com/outlook/dmo/digital-advertising/social-media-advertising/europe

Social Media Advertising—Worldwide. (n.d.). Statista. Retrieved 18 May 2023, from https://www.statista.com/outlook/dmo/digital-advertising/social-media-advertising/custom

Spremenimo svet: Agenda za trajnostni razvoj do leta 2030. (2015).

Svet Evropske unije. (2019, June 21). *Gospodarstvo blaginje – povzetek referenčnega dokumenta OECD o ustvarjanju priložnosti za blaginjo ljudi in gospodarsko rast*. Svet Evropske unije. https://data.consilium.europa.eu/doc/document/ST-10414-2019-INIT/sl/pdf

Swallow, T. (2022, May 25). *Top 10: Global sustainability trends for 2022*. https://sustainabilitymag.com/top10/top-10-global-sustainability-trends-for-2022

The Evolution of Social Media: How Did It Begin and Where Could It Go Next? (2020, May 28). *Maryville Online*. https://online.maryville.edu/blog/evolution-social-media/

The IUCN Red List of Threatened Species. (2022). https://www.iucnredlist.org/en

The SustainAbility Institute by ERM. (2022, January). *What's Next for Sustainable Business? 2022 Trends Report*. https://www.sustainability.com/globalassets/sustainability.com/thinking/pdfs/2022/esi-sustainability-trends-report-2022-2.pdf

Ting, S.-H., Ibrahim, S. H., Affandi, R., Baharun, A., Abidin, W. A. W. Z., & Sim, E. U.-H. (2015). Lifelong Learning for Personal and Professional Development in Malaysia. *HUMAN BEHAVIOUR, DEVELOPMENT and SOCIETY*, *12*(2), Article 2.

Toivonen, M., & Saari, E. (2019). *Human-Centered Digitalisation and Services* (Vol. 2019). Springer Nature Singapore Pte Ltd. https://doi.org/10.1007/978-981-13-7725-9

Trajnost. (2022). In *Fran*. https://www.fran.si/iskanje?View=1&Query=trajnost

Trend watch 2023: Sustainability. (2022, December 7). *NIQ*. https://nielseniq.com/global/en/insights/analysis/2022/trend-watch-2023-sustainability/

Trivium Packaging. (2022, April 22). *New Data Reveals Preference for Sustainable Packaging Remains Strong in a Changing World*. https://www.prnewswire.com/news-releases/new-data-reveals-preference-for-sustainable-packaging-remains-strong-in-a-changing-world-301530676.html

Ukaga, O., Maser, C., & Reichenbach, M. (2010). *Sustainable Development: Principles, Frameworks, and Case Studies*. CRC Press.

UNESCO. (2014). *Shaping the future we want: UN Decade of Education for Sustainable Development; final report*. https://unesdoc.unesco.org/ark:/48223/pf0000230171

UNESCO. (2017). *Education for Sustainable Development Goals: Learning objectives*. https://unesdoc.unesco.org/ark:/48223/pf0000247444

(UNESCO. (2022). *Vzgoja in izobraževanje za trajnostni razvoj, kažipot – VITR za 2030*. Zavod Republike Slovenije za šolstvo.

UNFCCC. (n.d.). *What is the United Nations Framework Convention on Climate Change?* Retrieved 12 August 2023, from https://unfccc.int/process-and-meetings/what-is-the-united-nations-framework-convention-on-climate-change

UNFCCC. (2019). *What is the Kyoto Protocol?* https://unfccc.int/kyoto_protocol

UNFCCC. (2023). *The Paris Agreement: What is the Paris Agreement?* https://unfccc.int/process-and-meetings/the-paris-agreement

United Nations. (n.d.). *The 17 sustainable development goals*. Retrieved 7 December 2023, from
    https://sdgs.un.org/goals

United Nations. (1987). *Report of the World Commission on Environment and Development: Our Common
    Future*. https://www.are.admin.ch/are/en/home/medien-und-
    publikationen/publikationen/nachhaltige-entwicklung/brundtland-report.html

United Nations. (2010, April). *UN competency development guide*.
    https://hr.un.org/sites/hr.un.org/files/Un_competency_development_guide.pdf

United Nations. (2011). *United Nations Competencies for the Future*.
    https://careers.un.org/lbw/attachments/competencies_booklet_en.pdf

United Nations Secretary - General's High-level Panel on Global Sustainability. (2012). *Resilient People,
    Resilient Planet: A Future Worth Choosing*.
    https://www.undp.org/turkiye/publications/resilient-people-resilient-planet-future-worth-
    choosing

Uprava družbe TRIGLAV SKLADI. (2021, July 12). *Metodologija za doseganje trajnostnih značilnosti naložb
    za portfelje Gospodarjenja s finančnimi instrumenti*.
    https://www.triglavskladi.si/assets/dokumenti/Metodologija_GFI_trajnostne-
    znacilnosti_14-okt-2022-v2.pdf

Urad za publikacije Evropske unije. (2011, April 4). *Kjotski protokol o spremembi podnebja*. https://eur-
    lex.europa.eu/SL/legal-content/summary/kyoto-protocol-on-climate-change.html

Urad za publikacije Evropske unije. (2019, December 12). *Montrealski protokol o substancah, ki škodljivo
    delujejo na ozonski plašč*. https://eur-lex.europa.eu/SL/legal-content/summary/montreal-
    protocol-on-substances-that-deplete-the-ozone-layer.html

Urad za publikacije Evropske unije. (2020, September 8). *Ženevska konvencija o onesnaževanju zraka na
    velike razdalje preko meja* [Website]. Publications Office of the EU; Publications Office of the
    European Union. https://op.europa.eu/sl/publication-detail/-/publication/5ab9bbd2-018b-
    43c1-99d3-3ac8f3b1c00b/language-sl

Urad za publikacije Evropske unije. (2021, June 7). *Kjotski protokol*. https://eur-
    lex.europa.eu/SL/legal-content/glossary/kyoto-protocol.html

Uradni List RS, Št. 46/06 in 8/17, 1. Člen, § 1. člen (2006). http://pisrs.si

Uredba (EU) 2020/852 Evropskega parlamenta in Sveta z dne 18. junija 2020 o vzpostavitvi okvira
    za spodbujanje trajnostnih naložb ter spremembi Uredbe (EU) 2019/2088 (Besedilo velja za
    EGP), 198 OJ L (2020). http://data.europa.eu/eli/reg/2020/852/oj/slv

Urednik. (2021, January 20). *Kaj so fosilna goriva?* https://www.cena-zlata.si/kaj-so-fosilna-goriva/

Uresničevanje Agende 2030. (n.d.). Portal GOV.SI. Retrieved 7 February 2023, from
    https://www.gov.si/zbirke/projekti-in-programi/uresnicevanje-agende-2030/

van Dijck, J. (2013). *Culture of Connectivity: A Critical History of Social Media* (Vol. 30). Oxford: Oxford
    University Press.

Video Marketing Statistics. (2022). Wyzowl. https://www.wyzowl.com/sovm-results-2022/

Virjent, D. (2023, March 30). *Kaj evropska Direktiva CSRD prinaša z vidika poročanja o trajnostnosti?*
    https://www.ey.com/sl_si/sustainability/kaj-prinasa-direktiva-csrd

Vrčon, M. (2023). *Podnebna freska (Climate fresque)*. NOO Projekt.
    https://www.digingreen.org/podnebne-spremembe-climate-fresque

Wakefield, F. (2022, June 22). *Top 25 recycling facts and statistics for 2022*. World Economic Forum.
    https://www.weforum.org/agenda/2022/06/recycling-global-statistics-facts-plastic-paper/

Wang, F., & Sun, Z. (2022). Does the Environmental Regulation Intensity and ESG Performance
    Have a Substitution Effect on the Impact of Enterprise Green Innovation: Evidence from
    China. *International Journal of Environmental Research and Public Health*, *19*(14), Article 14.
    https://doi.org/10.3390/ijerph19148558

WCED. (1987). *Our Common Future*. Oxford University Press.

Weiss, M., Zerfass, A., & Helmers, E. (2019). Fully electric and plug-in hybrid cars—An analysis of
    learning rates, user costs, and costs for mitigating CO_2 and air pollutant emissions. *Journal of
    Cleaner Production*, *212*, 1478–1489. https://doi.org/10.1016/j.jclepro.2018.12.019

What is a Nanodegree Program? (n.d.). Udacity Support. Retrieved 27 September 2023, from
        https://support.udacity.com/hc/en-us/articles/360015664831-What-is-a-Nanodegree-
        Program-

What is Digitalisation? (2022, December 19). WalkMe™ - Digital Adoption Platform.
        https://www.walkme.com/glossary/digitalisation/

WHO. (2021, December 21). *The Geneva Charter for Well-being.*
        https://www.who.int/publications/m/item/the-geneva-charter-for-well-being

Wike, R., Silver, L., Fetterolf, J., Huang, C., Austin, S., Clancy, L., & Gubbala, S. (2022, December 6).
        Social Media Seen as Mostly Good for Democracy Across Many Nations, But U.S. is a Major Outlier.
        https://www.pewresearch.org/global/2022/12/06/views-of-social-media-and-its-impacts-
        on-society-in-advanced-economies-2022/

Wiley, D., Bliss, T. J., & McEwen, M. (2014). Open Educational Resources: A Review of the
        Literature. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of Research
        on Educational Communications and Technology* (pp. 781–789). Springer.
        https://doi.org/10.1007/978-1-4614-3185-5_63

World Commission on Environment and Development. (1987). *Report of the World Commission on
        Environment and Development: Our Common Future.*
        https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

World Economic Forum. (2016). *The Future of Jobs: Employment, Skills and Workforce Strategy for the
        Fourth Industrial Revolution.* https://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf

Zakon o Visokem Šolstvu (ZVis), 33. Člen, Uradni list RS, št. 32/12 – uradno prečiščeno besedilo,
        40/12 – ZUJF, 57/12 – ZPCP-2D, 109/12, 85/14, 75/16, 61/17 – ZUPŠ, 65/17, 175/20 –
        ZIUOPDVE, 57/21 – odl. US, 54/22 – ZUPŠ-1 in 100/22 – ZSZUN § 33. člen (1994).
        http://pisrs.si

Zakonodaja. (n.d.). Portal EcoLex Life. Retrieved 3 December 2022, from
        http://ecolex.si/EcoLex/Predstavitev

Živčič, L. (2015). Odgovor na družbene, ekonomske in okoljske meje rasti: Predstavitev koncepta
        odrast (degrowth) ter njegova raba v praksi. *Časopis za kritiko znanosti, domišljijo in novo
        antropologijo*, 151–168.

Appendix 1: Learning units with an integrated sustainability component at the FLUM in the academic year 2021/2022

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
German in Logistics 2	Professional degree	1	Low	Sustainability
Green Technologies in Logistics Processes	Professional degree	4	High	Inclusion in the subject name, Sustainability, Green, Environmental protection
Professional Logistics Terminology and Communication in English 2	Professional degree	1	Low	Sustainability
Fundamentals of Logistics Processes and Sustainable Supply Chains	Professional degree	2	Low	Inclusion in the subject name, Sustainability
Operating a Sustainable Logistics Company	Professional degree	2	Low	Inclusion in the subject name, Sustainability
German in Logistics 1	University degree	1	Low	Sustainability
German in Logistics 2	University degree	1	Low	Green
Sustainable Supply Chain Management	University degree	5	High	Inclusion in the subject name, Sustainability, Social responsibility, Green, Environmental protection
Establishing and Assessing Sustainable Supply Chains	University degree	4	High	Inclusion in the subject name, Sustainability, Green, Environmental protection
Business Terminology and Communication in English 2	University degree	1	Low	Sustainability

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
Business Processes in Logistics Systems	University degree	4	High	Sustainability, Circular economy, Green, Ecology
Sustainable Logistics and Alternative Energy Sources	Master's	2	Low	Inclusion in the subject name, Sustainability
Transport and Logistics Terminals	Master's	1	Low	Sustainability
Supply Chain and Logistics Planning	Master's	2	Low	Sustainability, Environmental protection
Leadership Skills and Business Principles	Master's	1	Low	Sustainability
Transport and Warehousing	Master's	1	Low	Sustainability
Purchasing and Customer Service	Master's	1	Moderate	Sustainability, Circular economy, Ecology
Supply Chain Life Cycle Management	Master's	3	Low	Sustainability, Green
Urban Logistics and Mobility	Master's	2	Low	Sustainability
Intralogistics 4.0	Doctoral	1	High	Inclusion in the subject name, Sustainability, Green, Social responsibility, Environmental protection
Sustainable Transport Management and Integration into Supply Chains	Doctoral	5	High	Inclusion in the subject name, Sustainability, Green, Environmental protection
Corporate Culture in Supply Chains	Doctoral	1	Low	Sustainability
Circular Economy in Logistics	Doctoral	4	High	Inclusion in the subject name, Sustainability, Social responsibility, Circular economy

Appendix 2: Learning units with an integrated sustainability component at the FLUM in the academic year 2021/2022

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
Methods and Techniques of Planning Logistics Processes	Professional degree	2	Low	Informatics, Automation
Business Information Systems in Logistics	Professional degree	3	Moderate	Inclusion in the subject name, Informatics, Cybersecurity
Fundamentals of Computer Science in Logistics	Professional degree	4	High	Inclusion in the subject name, Informatics, Automation
Practical Training	Professional degree	1	Low	Computer
Informatics and Information Security in Logistics Processes	Professional degree	4	High	Informatics
Professional Logistics Terminology and Communication in English 1	Professional degree	1	Low	Inclusion in the subject name, Informatics, Cybersecurity, Computer
Purchasing Logistics	Professional degree	1	Low	Informatics
E-Commerce in Logistics	Professional degree	2	Low	Informatics
Digital Transformation in Logistics	Professional degree	3	Moderate	Inclusion in the subject name, Digitalisation
Intralogistics and Project Management	Professional degree	1	Low	Inclusion in the subject name, Digitalisation, Informatics
Fundamentals of Mechatronics in Logistics	Professional degree	2	Low	Informatics
Planning of Transport Operations	Professional degree	1	Low	Automation, Computer
Fundamentals of Spatial Modelling	Professional degree	3	Moderate	Digitalisation, Informatics, Computer
Warehouse Engineering and Technology	Professional degree	2	Low	Robotization, Automation

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
German in Logistics 1	University degree	1	Low	Informatics
Geographic Information Systems	University degree	2	Low	Inclusion in the subject name, Informatics
German in Logistics 2	University degree	1	Low	Informatics
Mechatronic Systems in Logistics	University degree	2	Low	Robotics, Automation
Computer Science in Logistics	University degree	4	High	Inclusion in the subject name, Informatics, Automation, Computing
Informatics and Information Security in Organisations	University degree	3	Moderate	Inclusion in the subject name, Informatics, Computer
Human Resource Management in Logistics	University degree	1	Low	Informatics
Transport Logistics	University degree	1	Low	Informatics
Digital Transformation in Supply Chains	University degree	3	Moderate	Inclusion in the subject name, Digitalisation, Informatics
Intralogistics and Project Management	University degree	1	Low	Informatics
Business Terminology and Communication in English 1	University degree	1	Low	Informatics
Business Terminology and Communication in English 2	University degree	1	Low	Informatics
Business Processes in Logistics Systems	University degree	1	Low	Informatics
Warehouse Systems and Warehouse Operations	University degree	3	Moderate	Robotization, Informatics, Automation
Logistics System Planning and Management	University degree	2	Low	Informatics, Automation
Stochastic Processes in Logistics	Master's	1	Low	Computer
Principles of Warehousing and Packaging	Master's	1	Low	Computer

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
Information Support for Logistics Processes	Master's	4	High	Inclusion in the subject name, Informatics,
Logistics and e-Business	Master's	3	Moderate	Automation, Computing
Communication in a Multicultural Environment	Master's	1	Low	Inclusion in the subject name, Digitalisation, Informatics
Project Management in Logistics	Master's	1	Low	Informatics
Introduction to Scientific Research	Master's	1	Low	Informatics
Scientific Research	Master's	1	Low	Informatics
Supply Chain and Logistics Planning	Master's	1	Low	Informatics
Management Skills and Business Principles	Master's	1	Low	Informatics
Transportation and Warehousing	Master's	1	Low	Informatics
Purchasing and Customer Service	Master's	1	Low	Informatics
Robotic Systems in Logistics	Master's	5	High	Informatics
Computer-aided Logistics Information Systems	Master's	3	Moderate	Informatics
Optimization of Logistics Processes	Master's	1	Low	Informatics
Advanced Geographic Information Systems	Master's	3	Moderate	Inclusion in the subject name, Robotization, Automation, Cybersecurity, Computer
Logistics Systems Management	Doctoral	1	Low	Inclusion in the subject name, Digitalisation, Informatics
Individual Research Work 1	Doctoral	1	Low	Informatics
Intralogistics 4.0	Doctoral	5	High	Inclusion in the subject name, Digitalisation, Robotization
Circular Economy in Logistics	Doctoral	1	Low	Computer
Reverse Logistics	Doctoral	1	Low	Computer

Name of the learning unit	Study programme	Level of sustainability integration	Assessment of the level of integration	Criteria covered
Information Systems in Logistics Processes	Doctoral	4	High	Involvement in subject name, Informatics, Cybersecurity, Computer

KNOWLEDGE SUPPLY CHAINS: ENHANCING WISDOM OF GREEN AND DIGITAL TRANSITION

MATEVŽ OBRECHT ET AL.

University of Maribor, Faculty of Logistics, Celje, Slovenia
matevz.obrecht@um.si

The scientific monograph explores sustainable development and digitalization in logistics and supply chain management. It begins with chapters defining concepts of sustainable development goals, environmental policy, sharing economy, de-growth and well-being economy. It highlights recent trends and integrates digitalization, emphasizing younger generations' perspectives on developmental opportunities within the sustainable development paradigm. Competency models for sustainability and digitalization are presented alongside lifelong learning as a mean enabling to fulfil the lack of knowledge in these areas. The research section assesses the integration of sustainable development into legislation and analyses sustainability and digitalization incorporation into Slovenian higher education programs, including overlaps. A quantitative study identifies crucial knowledge, skills, and priority areas for the green and digital transition to Society 5.0 in logistics and supply chains as the monograph focus. Perceived differences between economic sectors, students, and academics regarding key priority areas in logistics and supply chains are also explored.

OSKRBOVALNE VERIGE ZNANJA: SMERNICE ZA ZELENI IN DIGITALNI PREHOD

MATEVŽ OBRECHT ET AL.

Univerza v Mariboru, Fakulteta za logistiko, Celje, Slovenija
matevz.obrecht@um.si

Znanstvena monografija zajema najsodobnejše ugotovitve s področja trajnostnega razvoja in digitalizacije in njihovo aplikacijo na področje managementa logistike in oskrbovalnih verig. Teoretični del monografije odpirajo poglavja, ki se nanašajo na pojasnitev pojmov trajnostnega razvoja, kot so cilji trajnostnega razvoja, okoljska politika, trajnostna proizvodnja in potrošnja, delitvena ekonomija, koncept odrasti in ekonomija blaginje. V nadaljevanju so predstavljeni trendi s področja trajnosti in povezovanja področij digitalizacije s poudarkom na tem, kaj je aktualno in kaj mlajše generacije vidijo kot svoje priložnosti. Sledijo kompetenčni modeli s področja trajnosti in digitalizacije in vseživljenjsko učenje kot rešitev za zapolnitev vrzeli znanj pri posameznikih, ki so končali formalno izobrazbo v času, ko sta trajnost in digitalizacija predstavljali obrobni tematiki in še nista bili vidni kot prioriteti logistike in oskrbovalnih verig. Raziskovalni del se začne s predstavitvijo vključenosti trajnostnega razvija v obstoječi zakonodajni okvir. V nadaljevanju so predstavljeni rezultati vključenosti trajnostnih in digitalnih kompetenc v slovenske visokošolske programe in analiza prekrivanja le teh. Ključni raziskovalni del pa predstavljajo rezultati kvantitativne raziskave izvedene v gospodarstvu, akademiji in med mladimi, navezane na identifikacijo nujno potrebnih znanj in prioritetnih področij trajnostnega razvoja in digitalizacije v logistiki in oskrbovalnih verigah, ključnih za nemoten hkratni zeleni in digitalni prehod v družbo 5.0.

University of Maribor

Faculty of Logistics