RDIE focus area fact-sheets

I. DIGITAL SOLUTIONS ACROSS ALL AREAS OF LIFE

II. HEALTH TECHNOLOGIES AND SERVICES

III. VALORISATION OF LOCAL RESOURCES

IV. SMART AND SUSTAINABLE ENERGY SOLUTIONS

V. VIABLE ESTONIAN SOCIETY, LANGUAGE AND CULTURAL SPACE

RDIE focus area fact-sheets

I. DIGITAL SOLUTIONS ACROSS ALL AREAS OF LIFE

With the support of R&D, innovation and entrepreneurship:

- **digital solutions are created, delivered and used in every area of life;**
- **the data economy is used to create new business opportunities;**
- **secure cyberspace is ensured.**

1. Justification for the choice of focus area

Information and Communication Technology (ICT) horizontally through other sectors were already selected as a growth area in the course of RDI strategy 2014-2020 preparation. The development of the ICT sector continues to be important, as it provides a major local (e-governance) and global (export of smart solutions and e-services, cyber security, application of artificial intelligence, etc.) contribution to the functioning of society and the economy.

In recent years, R&D has mainly focused on:

- Artificial intelligence and machine learning - innovative solutions for creating automated systems, including healthcare (e.g. ICT-based solutions for e-health and personalised medicine) and e-government solutions.
- Data science and big data – solutions for user-centred e-Governance, including the Internet of Things, robotics, industrial automation, healthcare, etc.
- Robot-human interaction and the Internet of Things in industry, including the digitalisation of industry and optimisation of processes.
- Reliability of software, including measures of software correctness, safety, resource usage analysis, validation of analytical results and methods and tools for independent verification of certificates (e.g. for e-government and public services).
- The Internet of Smart Things, including both devices and technical solutions, as well as changes in processes (e.g. production processes) and in people's daily behaviour (e.g. health data).
- Security and reliability of hardware and systems, cyber defence – solving security problems related to cyber threats (e.g. in the fields of energy, communications, finance, transport, and security).
- Digital transition and lifelong learning by addressing not only the information technology dimension but also the social, cultural and values dimensions in the development and use of digital solutions for lifelong learning; the assessment and development of digital maturity of organisations and the adoption of digital innovations in education and entrepreneurship.

Links with underlying strategic guidelines

Areas of development needs under the **"Estonia 2035" strategy:** all areas, in particular the business environment, the cultural space and the living environment, security and safety, public administration

Smart specialisation growth area: yes

EU level: Objectives of EU digital transition, IPCEI value chains

United Nations Sustainable Development Goals (SDGs): in particular those on employment and growth, industry, innovation and infrastructure, peaceful and inclusive societies and global cooperation

Global trends: changing technology, changing business models and the changing nature of work, changing political systems and governance, changing nature of international conflicts and security threats

2. Estonia's strengths and development opportunities

Economic dimension: The role of the ICT sector in the Estonian economy is significant[1] – with around 5% of the total number of people employed in enterprises, it generates nearly 8% of the value added created by enterprises, pays over 6% of all taxes and levies withheld and paid by Estonian enterprises, and produces 11% of our exports. At the national level, it is important to develop and export e-services to other countries, which puts Estonia in a unique position as a world leader in this field. The Smart Specialisation Growth Areas Survey (2019) tracked the progress of the growth area 'ICT horizontally across other sectors' by niches and showed above-average economic growth compared to all economic activities.

Scientific dimension: most of the R&D in ICT is concentrated within the University of Tartu and TalTech (which are also responsible for the provision of higher education in ICT), in addition to Tallinn University, STACC OÜ, and Cybernetica AS. TalTech has the highest number of ICT researchers (more than 200 jobs), while the University of Tartu has around 150 ICT researcher jobs. Each year, researchers in the field of ICT publish more than 200 research publications, of which around one in six are among the top 10% of the world's most influential publications.

II. HEALTH TECHNOLOGIES AND SERVICES

With the support of R&D, innovation and entrepreneurship:

- **more effective and accessible health services are developed;**
- **patient-centred and evidence-based treatment and prevention services are developed and implemented;**
- **the export potential of the healthcare system is expanded.**

1. Justification for the choice of focus area

Links with underlying strategic guidelines

Areas of development needs under the **'Estonia 2035' strategy:** health and life expectancy

Smart specialisation growth area: yes

EU level: EU missions, IPCEI value chains

UN Sustainable Development Goals: health and well-being

Global trends: growing and ageing population

The health sector, including social care, accounts for 4% of the Estonian economy. Like other developed countries, Estonia faces rising health care costs related to structural changes in its population, the increase in chronic and infectious diseases (including epidemics/pandemics) and the introduction of new expensive treatments and health technologies. The health and well-being of people are also affected by environmental and climate changes, and adapting to them, which might place additional pressure on the social and health systems of countries in the years to come.

The development of health technologies and services has a potentially strong socio-economic impact. Estonia has the potential to become a leader in foreign markets with its innovative and high value-added technological solutions, as many countries are looking for new business models and technological solutions to ensure the sustainability of their healthcare systems. At the same time, the field contributes to solving a number of societal challenges (including the development needs of the 'Estonia 2035' strategy) by improving the availability and quality of health services

1 An overview of the economy, vocational training, higher education and R&D in the field of ICT. Information Technology Foundation for Education (HITSA), 2019

and reducing the workload of healthcare professionals. Innovative solutions in the field of personalised medicine will also provide an opportunity to move from curative to preventive medicine, extend healthy life expectancy and ensure sustainable financing of healthcare. Patient-centred approaches (personalised medicine, gene banks), big data analytical solutions and a health economy focused on improving people's health and increasing their life expectancy through the introduction of new health technologies and services will become increasingly important. By virtue of Estonia's small size, mobility and technological openness, the country has the potential to become a pioneer in innovative healthcare.

2. Estonia's strengths and development opportunities

Economic dimension: the Smart Specialisation Growth Areas Survey (2019) monitored the progress of the growth area of health technologies in the form of e-health and red biotechnology niches, and pointed to above-average economic growth compared to all economic activities.

Scientific dimension: Estonia's strengths in the field of health technologies and services are based on cutting-edge biomedical and biotechnology research, a strong and innovative ICT sector, national digital infrastructures (x-Road, the Patient Portal www.digilugu.ee), and a flexible public administration that enables the rapid deployment of new solutions. Estonia's potential is mainly related to the development of e-solutions (including big data solutions), the introduction of new technologies and the development and implementation of personalised medicine. There is a potential for a significant leap forward if biomedicine and biotechnologies are linked to clinical medicine. The potential also exists in the application of the data economy, including intelligent data management systems and artificial intelligence, and in the development of health-promoting technologies and services that can be implemented outside of Estonia. Possible topics in the area include:

- solutions for data use and automated decision support in the medical system;
- integrating new services, such as e-health and personalised medicine, into everyday healthcare;
- supporting the entry of private services into the market alongside public services, thereby also increasing people's own responsibility for maintaining and strengthening their health.

Research expertise in health technologies and services rests in Estonia's major universities (the University of Tartu, TalTech, and Tallinn University), research institutes (National Institute Of Chemical Physics and Biophysics, National Institute for Health Development), research development centres (Center of Food and Fermentation Technologies, TervisTAK), three centres of scientific excellence (Centre of Excellence for Genomics and Translational Medicine, Centre of Excellence in Molecular Cell Engineering, Estonian Centre of Excellence in ICT Research (EXCITE)) and private companies. The most important competence centres are the University of Tartu Institute of Genomics and the Estonian Genome Project, which hold the position of global leader in the development of personalised medicine based on gene data. Estonia has strong R&D-based medical institutions: TÜ Kliinikum (Tartu University Hospital) and Põhja-Eesti Regionaalhaigla (North Estonia Medical Centre). There is also a growing development of health-related information technologies at the University of Tartu Institute of Computer Science and the TalTech Department of Health Technologies.

III. VALORISATION OF LOCAL RESOURCES

With the support of R&D, innovation and entrepreneurship, local resources will be exploited in a manner that is sustainable, biodiversity-friendly and highly resource-efficient, focusing on both primary and secondary raw materials, and enhancing the bio- and circular economy.

1. Justification for the choice of focus area

Links with underlying strategic guidelines

Areas of development needs under the **'Estonia 2035' strategy:** business environment, biodiversity and environment

Smart specialisation growth area: yes

EU level: European Green Deal, EU missions

United Nations Sustainable Development Goals (SDGs): eradication of hunger, sustainable energy, employment and growth, sustainable production and consumption

Global trends: scarcity of natural resources, ongoing climate change and deteriorating environment

For the period 2014-2020, the focus was on three topics: the valorisation of wood, food and mineral resources. The topics were chosen based on the need to maximise the value of raw materials available in Estonia, to provide the highest economic added value to raw materials, to develop and introduce technologies that conserve raw materials and have the least impact on the environment. In the case of mineral resources, it is also important to further map and explore the resources available in Estonia and to identify the opportunities for their exploitation.
While the previously agreed topics included the valorisation of wood, food and mineral resources, consideration should be given to expanding the context of local resources, e.g., secondary raw materials and waste management.

2. Estonia's strengths and development opportunities

Economic dimension:

The wood industry generates 3.5% of total employment and over 4% of the value added in the business sector, and constitutes nearly 17% of Estonia's exports. The Estonian wood industry focuses mainly on the mechanical processing of timber, with virtually no high productivity chemical and/or molecular processing technologies available. At the same time, the global market for cellulose fibre products continues to show a significant rate of growth each year. There are around 1000 companies currently active in the wood industry in Estonia. The industry employs more than 15,000 people, mainly in the area of mechanical wood processing. Chemical processing of wood is carried out by two large companies: Estonian Cell AS and Horizon Tselluloosi ja Paberi AS.

The food industry , i.e. agriculture, fisheries and agri-food sectors, accounts for approximately 5% of the value added and employs approx. 6% of the workforce. There are more than 500 active companies and the industry employs more than 15,000 people. The total sales revenue of the companies was EUR 2.1 billion in 2017, which accounted for 3.5% of the total sales revenue of all Estonian companies. The food industry represents nearly 15% of the total manufacturing industry, and companies produced goods worth EUR 1.5 billion in 2017, 33% of which was exported. The sector is dominated by micro and small enterprises. Medium and large enterprises constitute around 13% of the sector's enterprises, while also accounting for more than 80% of the sector's sales and employing nearly 80% of the total workforce. The largest companies in the sector are AS Balbiino, AS Eesti Pagar, AS Liviko, Saku Õlletehase AS, Kulinaaria OÜ, Lunden Food OÜ, AS A. Le Coq, AS Farmi Piimatööstus, Orkla Eesti AS, Premia Tallinna Külmhoone AS, Valio Eesti AS, and HKScan Estonia AS. The Estonian food industry is mostly engaged in product development; R&D is outsourced to foreign-based providers.

The number of companies dealing with **mineral resources** accounts for just 0.2% of all enterprises in Estonia, while the number of people they employ represents 3.65% of the total number of people employed by Estonian companies. The total sales revenue of the companies involved in the industry was EUR 2.4 billion in 2017, which accounted for 4% of the total sales revenue of all Estonian companies. Large companies represent less than 10% of the industry; however, their sales revenue accounts for 74% of the total sales revenue. The main exploitable mineral resource has been oil shale; however, its importance is expected to decrease in the future. Little to no exploration has been done over the years on other mineral resources; therefore, there are no major companies exploiting local mineral resources other than shale oil in Estonia. However, Estonia has a variety of mineral resources that are in demand worldwide. The orientation of companies towards R&D is hampered by uncertainties regarding the accessibility of mineral resources. The state has a major role to play in commissioning the necessary research and setting industry development priorities.

In addition to exploiting local resources, the resource productivity of **secondary raw materials and waste** should also be increased. On average, raw materials account for 40% of the costs incurred by European industrial undertakings. Together with energy and water, this represents 50% of total production costs. In monetary terms, Estonia is lagging behind many other EU countries when it comes to the efficient use of resources. Domestic material productivity (the ratio of GDP to domestic use of raw materials) was 0.47 EUR/kg in 2018, compared to an EU average of 2.09 EUR/kg. However, the indicator depends heavily on the unit weight of a country's local resources. For example, in Finland (1.34) and Sweden (1.87) – environmentally sustainable countries rich in timber and mineral resources – resource productivity is also below the EU average.

Similarly to the maximum valorisation of local primary raw materials, secondary raw materials and waste generated in Estonia could be treated as a local resource, thus reducing dependence on the imports of these materials. The focus is on the development of smart and value-added local uses for secondary raw materials and waste (e.g. plastics, textiles, metals, and mineral waste) already circulating in the Estonian economy. In 2018, 41% of waste was recovered in Estonia, i.e. reused as a raw material. As further valorisation of these materials will reduce the costs of waste management, R&D in this field is a promising avenue from both an economic and an environmental perspective. Several large-scale research and development projects have already been supported by the environmental programme of the Centre for Environmental Investments; however, the potential of this programme to trigger systemic change is limited.

The Smart Specialisation Growth Areas Study (2019) identified energy and resource efficiency in construction and buildings, timber in construction, nano- and surface-coating technologies, oil shale in the chemical industry and raw materials for food as growth niches for resource valorisation, and pointed to diversified growth outcomes compared to all sectors of the economy. One of the five niches – nano- and surface coating technologies – raised questions. Due to significant changes in large companies, sales revenue and the number of employees decreased in the field of construction in the areas of energy and resource-efficiency, and in oil shale in the chemical industry.

Scientific dimension: although Estonian researchers are among the best in the world in several areas related to the valorisation of resources, the results of their research fail to reach the economy and remain confined to lower Technology Readiness Levels (TRL)[2]. According to the Web of Science, Estonian researchers outperform the world's top 50% in terms of the average impact in nine areas related to resource valorisation, including molecular biology and genetics, physics, plant and animal sciences, ecology, pharmacology and toxicology, biology and biochemistry, and microbiology. At the same time, fields such as agriculture, chemistry, earth sciences, engineering and material sciences are below the world average in Estonia. The demand of enterprises for research and development in raw material processing is growing.

2 TRL1-TRL4: the basic principles of the technology are being studied (e.g. basic research and literature reviews); the technological concept is being formulated (e.g. the necessary analytical studies and experiments or the methodology for carrying them out are formulated); experimental proof of key performance and concept is provided (e.g. analytical and laboratory studies); the performance of the technology components is validated in the laboratory (e.g. design, development and laboratory testing of technology components).

In the wood industry, there is a growing demand for the chemical refining of timber, with the world moving towards the following:

- wood sugars and lignin, their use in bioprocesses, fermentations, the production of industrial intermediates;
- the use of lignin as a raw material in the material and chemical industries;
- conversion of lignin to intermediate residues and their use in more specific chemical and material industries;
- replacing fossil-based products with wood derivatives.

Four research institutes are involved in wood valorisation research, covering research topics in both mechanical and chemical wood processing. Competence in chemical valorisation of wood is mainly concentrated in two major universities – the University of Tartu, and Tallinn University of Technology – but also in the Estonian University of Life Sciences and the Estonian Academy of Arts; however, the existing research capacity is modest and the research groups are small.

Global market trends in the valorisation of **food resources** are as follows:

- smart manufacturing and process innovation – higher productivity and full valorisation through resource-efficient production, including the optimisation of technological processes and the sourcing of suitable raw materials;
- innovative valorisation of food and food ingredients;
- application of environmentally friendly and organic production methods in agriculture, precision farming and waste reduction in food systems, as well as the valorisation of generated waste;
- replacement of synthetic pesticides and mineral fertilisers with alternative pesticides and fertilisers;
- packaging – environmentally friendly packaging, use of recovered materials in packaging;
- changes in consumer preferences – products with lower salt, sugar and fat content, preservation of flavour, replacement of animal protein with plant-based protein;
- food safety – IT solutions for monitoring food safety and the movement of food, resistance to microbes and antibiotics.

Six research institutes (the University of Tartu, TalTech, the Estonian University of Life Science, the National Institute of Chemical Physics and Biophysics, the Centre of Food and Fermentation Technologies, and BioCC) are involved in food valorisation. The best publicly known example of R&D in this field and its application is the valorisation of dairy products with *Lactobacillus fermentum* ME-3 (University of Tartu).

In the area of mineral resources, we need to map and explore both the existing and the exploitable, as well as potential and currently unexploited mineral resources, such as phosphate rock and rare earth elements. The need for the exploration of Estonia's mineral resources stems from research being performed by the global economy towards decarbonisation. As a result, there is a rapidly growing demand for renewable energy equipment, including high-tech metals (battery metals and electrolyser components). Critical elements for renewable energy and battery applications are Ga, In, Se, and Te, rare earths, Co, Li, V, Mo, Cu and Mn, as well as elements within the platinum group. As resources are scarce, the demand and the price for these elements are expected to skyrocket in the coming decades.

Two research institutions (TalTech and the University of Tartu) and the Geological Survey of Estonia are directly involved in the research of mineral resources. Most of the current research projects are associated with oil shale, oil shale chemistry, and the subfield of chemical engineering.

The high-quality uptake of **secondary raw materials and waste** is a pan-European challenge. By focusing on developing solutions that are attractive and of interest not only in the context of Estonia, but also elsewhere, Estonia has the potential to become a centre of excellence and development in these areas. In addition to finding solutions to specific waste flows, it is also a question of smart design. EU and international strategic future trends in this area point towards the phase-out of hazardous substances and the search for chemical-free solutions (implementation of the principles of green and sustainable chemistry and 'safe by design'). The aim is to consider the entire life cycle of the product, starting from the product design stage – if hazardous substances are added at the design stage, this limits resource recovery at the waste stage. In Estonia, Ida-Viru County would be an attractive region for this direction, as it generates large quantities of mineral waste, the use of which still requires a considerable amount of R&D input. There is also a potential to develop regional activities, for example, for textile waste, plastic waste, and other secondary resources. TalTech, the University of Tartu, the University of Life Sciences, the National Institute of Chemical Physics and Biophysics and Tallinn University of Applied Sciences have been involved in the development of uses for secondary raw materials and waste.

IV. SMART AND SUSTAINABLE ENERGY SOLUTIONS

With the support of R&D, innovation and entrepreneurship:

- **Estonia produces energy in a climate-neutral manner;**
- **energy use in Estonia is improved and made more resource efficient;**
- **a contribution is made to ensuring energy security.**

1. Justification for the choice of focus area

Links with underlying strategic guidelines

Areas of development needs under the **'Estonia 2035' strategy:** the business environment, biodiversity and the environment, the cultural space and the living environment

Smart specialisation growth area: yes

EU level: EU climate objectives and European Green Deal, IPCEI value chains, EU missions

United Nations Sustainable Development Goals (SDGs): sustainable energy, jobs and growth, industry, innovation and infrastructure, sustainable cities and human settlements, sustainable production and consumption, action against climate change

Global trends: continued climate change and environmental degradation, scarcity of natural resources

The world is facing climate change and environmental degradation, which affects our quality of life, nature and the economy. Estonia's economy is one of the most emissions-intensive in Europe, with double the amount of greenhouse gas emissions per euro of GDP than the EU average (in 2017). Estonia is also one of the EU's most energy-intensive countries[3], ranking second in Europe and more than four times below Europe's leaders in energy efficiency (Ireland, Denmark, Luxembourg, and Italy). Thus, the EU's plan to reach climate neutrality by 2050 will directly affect Estonia's choices – energy efficiency must be increased, and low-carbon energy production options must be found. Moving away from the current fossil fuel-based energy model to diverse options based on renewable sources, smart grids and storage is crucial, while considering supply needs and security. In this context, it is important to increase the energy efficiency of production processes, in order to disconnect Estonia's GDP growth from energy consumption growth. To support Estonia's energy transition, Estonian researchers and companies must be at the forefront of technology development. The RDI activities needed to achieve this include the development and testing of new technological solutions, the development of products and services based on new technologies, and social innovation to change societal behaviour.

According to the International Energy Agency (IEA), countries are investing approximately USD 30 billion per year in the development of energy-saving technologies, and the investments are growing at an average annual rate of 5–7%. Nearly 80% of investments are related to the development of low carbon energy technologies: renewable, nuclear, and hydrogen energy, energy storage and smart grids. Renewable energy solutions are the fastest growing area of investment. Private R&D investment has increased the most in the field of energy-efficient transport (mainly electric cars and charging solutions), followed by energy storage, hydrogen energy, and fuel cell development, solar and bioenergy. Therefore, the solutions to be developed also possess great business potential outside Estonia, as all countries in the world are facing similar problems.

3 Energy intensity shows the amount of energy used by a country's economy, in other words, how much primary energy (energy contained in all energy sources used) is used per unit of gross domestic product (GDP) (measured in monetary units) per year. The higher the energy intensity, the lower the energy efficiency of the country.

The EU[4] foresees growth in RDI and breakthroughs in the field of renewable energy, in particular in the following areas:

- methods and solutions for energy efficiency, including sustainable energy use (including energy performance of buildings);
- energy storage options, including batteries and hydrogen-based fuel cells;
- development of smart grids, including demand and supply management, application of blockchain technologies, and combined energy solutions;
- research into artificial photosynthesis and bioenergy (energy harvesting).

2. Estonia's strengths and development opportunities

Although Estonia is unable to invest in volumes comparable to those of large countries, its advantages are its small size, flexibility and speed. Estonia can offer sand-box type solutions, where prototypes that have been tested in the lab are applied in a real-life environment on a smaller scale, e.g. in a local municipality, and if successful, can be flexibly scaled up. To do so, we will need to be at the forefront of development and keep abreast with the latest research and technological progress.

Economic dimension: According to the Baltic energy technology scenarios (Lindroos et al. 2018), Estonia possesses excellent potential for the development of renewable energy and sufficient local resources to produce most of its consumed energy from renewable sources. At the same time, electrification of energy solutions, the use of renewable energy sources and energy efficiency improvements in buildings could reduce energy use efficiency per unit of GDP produced by up to five times. Developing and deploying solutions that reduce the use of fossil fuels would also contribute to maintaining Estonia's energy independence and ensuring security of supply.

A number of Estonian start-ups, such as Roofit Solar, Skeleton, Elcogen and others, are achieving success in smart and sustainable energy technology solutions.

Scientific dimension: research and development of smart and sustainable energy solutions, including gas fermentation, hydrogen technologies, fuel cells and smart grids, is carried out at the University of Tartu, TalTech, and the University of Life Sciences. Universities have the capacity to combine all of the primary methods of generating, converting and storing renewable energy, and are developing novel materials for energy management and storage. In the field of energy efficiency, there is a centre of excellence in construction, focusing on the construction of near-zero energy buildings. Alongside natural sciences and engineering, Estonia has a strong school of environmental scientists, with a number of Estonian researchers ranking among the leading researchers in the world. It offers opportunities to combine technological developments with knowledge of environmental changes and to find new smart solutions that respect the environment.

4 https://ec.europa.eu/info/sites/info/files/cheap-renewable-energy-targeted-scenario-3_2018_en.pdf

V. VIABLE ESTONIAN SOCIETY, LANGUAGE, AND CULTURAL SPACE

Supported by R&D, innovation and entrepreneurship:

- **the Estonian nation, language and cultural space are viable and evolving;**
- **Estonia's governance is more people-centred, knowledge-based and efficient;**
- **the Estonian people acquire knowledge, skills and attitudes that enable them to achieve fulfilment in their personal lives, work and society, and support the sustainable development of Estonian society;**
- **the economy and technology develop in a people-centred way and take into account socio-cultural impacts.**

1. Justification for the choice of focus area

Links with strategic underlying strategic assumptions

Areas of development needs under the **'Estonia 2035' strategy:** population, health and life expectancy, society and opportunities, learning opportunities, cultural space and living environment, security and safety, and governance

Smart specialisation growth area: no, but supports the realisation of the potential of smart specialisation growth areas with their socio-cultural dimension

EU level: -

United Nations Sustainable Development Goals (SDGs): vitality of the cultural space, quality education, the development of peaceful and inclusive societies, as well as gender equality and the reduction of inequalities

Global trends: changing technologies, changing business models and the nature of work, demographic changes, changing political systems and governance, migration and urbanisation

Changes at both the global and national level open up two perspectives. On the one hand, they require not only the development and implementation of innovative solutions and technologies, but also a change in the way society works and in the way people behave and think. For example, coping with climate change and environmental degradation will require a change in consumption patterns; the widespread use of digital technologies and e-services, as well as the increasing interconnection and automation of people and machines in the labour market, will require reshaping the existing skills and knowledge profile, a response from the education policy, etc. On the other hand, global and national changes will, in turn, bring about changes in the functioning of society (education, culture, work life, the social sphere, and civil society, etc.), more specifically in patterns of behaviour, value systems, etc. The socio-cultural aspect and the openness of society to change and innovation are essential prerequisites for economic growth and greater competitiveness at the international level, as well as for changes of a more global nature (including the digital and green transitions). Understanding societal processes and human behavioural patterns is an essential prerequisite for understanding and supporting development in all areas of life (and in other focus areas). The responsibility for carrying out high level research on the Estonian language, culture and history, and for interpreting of the research results lies, first and foremost, with Estonian society – on the one hand, this is a moral responsibility, while on the other hand there are topics that are not reflected or are not successful in the context of overall global competition. Studies of Estonian society, language and the cultural space play a dual role in the research system: on the one hand, the results have to be fed back to society and serve as an input, e.g. for the education system and, on the other hand, the performed research must be competitive in the arena of international research.

The field of a viable Estonia encompasses different areas of life and themes, which are connected by the fact that they focus directly on Estonian society, the Estonian nation and the Estonian cultural space. The development of the field is necessary for the functioning of Estonian society and the state, even if it has little economic value and potential. Research in this field is important for the survival and development of the Estonian state and society, the Estonian nation and language, including for studying the functioning models of Estonian society, solving the development

needs of society and supporting adaptation to global developments. Research in the field has a strong socio-cultural dimension: the results of research provide input for our education system and public services, and support the realisation of the potential of economic and smart specialisation growth areas.

The focus is on (basic) research in the fields of social sciences, humanities and arts[5], which contribute to the objectives of the survival and development of the Estonian state and society, language and culture, including

- studies of the Estonian language and culture. The culture and cultural heritage, including linguistic research for the development and application of language technologies;
- educational research for the development of ways and forms of learning adapted to a changing world, for matching the needs of education and the labour market, including the necessary basic research for the development and implementation of teaching materials and methodologies, etc.;
- social and demographic research, including the contribution of the (basic) sciences to the study of the patterns of societal functioning, to the solution of problems relating to population, the social field, work life, well-being, social cohesion, human development, etc., and, inter alia, to the enhancement of society's resilience and capacity to cope with crises.

2. Estonia's strengths and development opportunities

Economic dimension: the economic dimension and potential are covered directly by the creative economy[6], but also in a more indirect manner, e.g. by the general readiness of society to adapt to the digital and green transitions, which have a clear economic output, and more specifically, e.g. in the application of language technology solutions to improve citizen-state interaction (public services), the quality of services at the business and customer level, etc. In other respects, Estonian research supports the functioning and sustainability of the state and society, as well as the application of research results and the realisation of the economic potential in other areas (e.g. the important role of social sciences in supporting the application of innovative technologies, basic research in the field of language for the application of language technologies, as well as input to the education system, public services, etc.). **Activities in the area of a viable Estonian society, language and cultural space are a prerequisite and a basis for achieving the objectives of other focus areas.**

Scientific dimension: compared to other focus areas, the humanities, arts and social sciences play an important role in Estonian studies. Research institutions and teams in the field:

- the Estonian language and culture – the University of Tartu, Tallinn University, the Estonian Academy of Arts, the Estonian Academy of Music and Theatre, the Institute of the Estonian Language, the Estonian Literary Museum, the Under and Tuglas Literature Centre, and the Estonian National Museum
- educational research – the University of Tartu, Tallinn University
- social and demographic research – the University of Tartu, Tallinn University, and TalTech

5 According to the Frascati Manual, the social sciences, the humanities and the arts are classified as follows: psychology and cognitive sciences, economics and business, education, sociology, law, political science, social and economic geography, media and communication, other social sciences, history and archaeology, languages and literature, philosophy, ethics and religion, arts (art history, performing arts, music), and other humanities.

6 The creative economy is a sector of the economy that is based on individual and collective creativity, skills and talents, is capable of generating wealth and jobs through the creation and use of intellectual property as a key selling point, in which creative thinking and creators are central to the processes. The creative economy concerns the production and dissemination of goods and services which, at the time of their development, are believed to have a specific characteristic, use or purpose that includes or conveys cultural value, regardless of their potential commercial value, or which use culture as an input and have a cultural dimension but whose output is primarily functional. This includes, for example, performing arts, visual arts, cultural heritage, cinema, DVD and video, TV and radio, video games, new media, music, books and publications, as well as architecture, design, fashion, and advertising.