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Improving Structural Funds for better delivery of R&D&i policies

Regional State of the Art Report

Tartu, Estonia

May, 2020

TARTU SCIENCE PARK

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1. Introduction

Compilation of the State of the Art report is one of first activities to be performed by the IMPROVE project's partners within the Exchange of Experiences work package and serves as foundation for future work processes providing snapshot of current regional and national environment and base level for measuring developments and progress in future with chosen policy instrument.

The objective of the State-of-the-Art report is to clarify the current situation in terms of management and implementation of Structural Funds, with a special focus on the policy instruments selected by each partner.

In that respect, Tartu Science Park has selected the policy instrument of Tartu City – Development Plan of Tartu 2018 to 2025. It sees Tartu as the intellectual capital of Estonia and the centre for promoting development in South Estonia as a whole. According to the vision of Tartu 2030, the city is a "university town with traditions, a city of youth where creativeness and open reasoning support development activity and innovation in entrepreneurship, a city with modern urban environment, safe, developing, sustainable way of life and an actively cooperating Estonian city."

2. Regional profile

2.1. Overview of the region in term of economic profile

Local context profile:

- The second largest city of Estonia
- Area: 38.8 square kilometres
- Population: about 100,000 inhabitants
- Distances from Tartu: Tallinn 186 km, Narva 184 km, Pärnu 178 km, Riga 250 km, St. Petersburg 315 km
- Ethnic composition: Estonian 76%, Russian 19%, others 5%

Tartu, with its population of around 100,000 in an area of 38.8 square kilometres, is the second largest city of Estonia. Lying 185 kilometres south of Tallinn (the capital city of Estonia) it is also the centre of southern Estonia. The Emajõgi River, which connects the two largest lakes of Estonia, flows for the length of 10 kilometres within the city limits and adds colour to the city.

Tartu has all the required elements to be globally connected and competitive, but with the "local" advantages: the living costs are lower, security level is higher, and the air is cleaner than in Tallinn, Helsinki or New York. Access to Estonia's central market region, a well-educated and qualified work

force, a good transport system and a fully modernised business infrastructure has made Tartu an attractive location. The geographical location has made this historical Hanseatic city attractive logistically. By car/bus it takes no more than 2.5 hours to travel to Tallinn, or 3.5 hours to Riga.

Culture and history

Being the oldest city in Estonia, Tartu successfully combines modern infrastructure and facilities with green and friendly environment: the city is very compact and easily accessible. A serene park with medieval ruins and a river running through the city give it a romantic appeal. Part of its appeal is the way Tartu blends old and new. Walking through the city, one can literally touch its history, at the same time feeling a renewed energy and curiosity about what the future will bring. The balance between past and future is an essential part of the celebrated spirit of Tartu. At every corner in Tartu, there are concert venues, exhibition halls, theatres, churches, museums and charming little cafes as well as various pubs and restaurants. An inseparable part of the city is its students, who comprise around a quarter of the population and generate a lot of fun and energy. There is a lively cultural scene with something for every taste. Exciting events and festivals take place all year round.

The economy in Tartu

Tartu is a city that promotes innovation via competitive enterprises, being attractive to investors and facilitating entrepreneurship and knowledge-based production and services. Tartu is a city in motion,

empowered by the changes that have taken place over the last decade. These changes have been radical with a substantial influence on citizens´ welfare and business growth.

The region´s infrastructure has been extensively updated and is ready for further expansion. A development strategy and detailed action plans have been prepared and put into force in most areas, to maximise the potential development. Recognising that the city and county are mutually dependent, the administrations of both are actively coordinating at every level to continue the rapid tempo of positive change. Long traditions and high competence in electronics, information and biotechnology have made our enterprises internationally competitive. The region's infrastructure has been extensively updated and Tartu and Tartu County administrations are cooperating in the development strategies and detailed action plans to maximize potential and maintain a rapid tempo for city and county development.

Tartu is Estonia's leading centre of education and research. Tartu has 11 higher education institutions, with a total of 16,400 students, conducting internationally recognized research and providing world-class research-based higher education. The University of Tartu (www.ut.ee), founded in 1632, is one of the oldest universities in North-Eastern Europe and is ranked in the top 2% of the world's best universities. The second largest, the Estonian University of Life Sciences (www.emu.ee), is one of top 100 universities in the world in the field of agriculture and forestry.

Long traditions and high competence in metalworking, electronics, information and communication technologies, wood processing, food industry and biotechnology have made our enterprises internationally competitive. In the beginning of the 21st century, many ICT enterprises and other high-tech companies have taken a foothold in Tartu. Estonia has made a name for itself for the innovative application of communications technology, where state-of-the-art technologies are a way of life. Tartu has always been a trendsetter when it comes to ICT developments – talented minds and ambitious entrepreneurs have led to a rapidly growing ICT ecosystem which has attracted the attention of venture capitalists as well as foreign ICT companies. For example, in 2016, the city hosted more than 60 startup events (from hackathons (garage48.org) to Mobile Monday (www.momoestonia.com/) to sTARTUp Day (www.startupday.ee) etc), with more than 5000 people from the tech industry getting involved.

Key Sectors

Biotechnology

Tartu is the centre of Estonia's medical and biotechnological landscape. The main areas of expertise in this emerging sector of the region lie in the fields of biochemistry, genetics and heredity, neuroscience and bioinformatics. There is a well-developed network of private clinics in Tartu. Clinics collaborate closely with the research and development institutions as well as other companies. Specialists for the rapidly growing sector are provided by the University of Tartu (www.ut.ee), the Estonian University of Life Sciences (www.emu.ee) and Tartu Health Care College (www.nooruse.ee).

The City of Tartu has declared biotechnology one of its focus areas in its strategy. However, the significance of biotechnology is not only limited to the municipal level: biotechnology is defined as one of the strategic key sectors of Estonia. **Tartu is the Best Place for a Biotechnology Business:**

- Centre of expertise for life sciences and medicine: more than eight research organisations, 11 universities and colleges;
- Centre of health care in Estonia: Tartu University Hospital, many private clinics, medical tourism;
- Nordic, educated and disciplined labour force for the biotechnology and healthcare sector;
- Supporting infrastructure: Tartu Biotechnology Park (biopark.ee), modern laboratories, technological solutions for development and innovation.

Information Technology

Estonia has made a name for itself with the innovative application of information communications technology, where state-of-the-art technologies are a way of life. Tartu has always been a trendsetter when it comes to ICT developments: talented minds and ambitious entrepreneurs have led to a rapidly growing ICT ecosystem which has attracted the attention of venture capitalists as well as foreign ICT companies. For example, in 2018, the city hosted more than 80 startup events (from hackathons to MobileMonday to sTARTUp Day (www.startupday.ee), etc.), with more than 5,000 people from the tech industry getting involved.

The ICT sector in Tartu is characterized by a few leading companies and many startups who have partially grown out of these large companies and who supplement each other and form a well-working cluster. The ecosystem is not only being supported by the companies, but also by several technological institutions like the Software Technology and Applications Competence Centre (www.stacc.ee), the Buildit Accelerator (www.buildit.ee), sTARTUp HUB (www.contriber.com/startup-hub), Tartu Science Park (www.teaduspark.ee) and the Smart City initiatives (http://tarktartu.ee/eng/). The aforementioned institutions also form integral part of the business support ecosystem of Tartu.

Metal-processing and Machine-building

The metal industry is the third largest industry in Estonia. The Tartu region has traditionally been the centre of Estonian research and development with its internationally renowned universities. Expertise, international contacts and traditions characterise the metal-working and machine-building industry in Tartu.

The sector varies from historical string agricultural and forestry machines to apparatus manufacturing to new production of c**ar parts and trailers**. And, last but not least, producers of steel structures have profited from the favourable environment created by the building boom propelled by the Estonia's accession to the EU.

The key strengths of the sector include: long-lasting traditions; strong, successful companies active in export (Tarmetec, Hanza Mechanics); availability of properties; support services (research and

development, centres of excellence); and, compatible curriculums in university and vocational schools (such as Tartu Vocational Education Centre), which means highly educated engineers, semi-industrial labs and equipment.

Woodworking Industry

Wood-processing has historically been a mainstay of the Estonian economy, the output of which is based on local and renewable raw materials. Similar to the technological leap made in other sectors of the economy, the flow of new investment has brought state-of-the-art equipment to all areas of the wood processing industry.

The range of wood industry products is extensive, beginning with the production and treatment of sawn timber and leading to the production of wooden houses, windows, and doors. Creative thinking and innovations are helping to break traditions in the wood industry: Estonian design accessories like bowties, watches and frames for glasses are becoming increasingly popular.

The key strengths of the sector include: Long-lasting traditions; strong, successful companies active in export (Kodumaja, Lemeks); availability of properties; support services (research and development, centres of excellence, competence centres); proximity of raw materials; co-operation partners; and, innovative solutions.

Food Industry

The food industry is an essential part of the manufacturing industry in Estonia. The most important branches of the food industry in Tartu and Estonia are similar: the dairy, beverage, meat and bread industries. Exports make up about one third of the total production volume. In addition to the big players, quite a large number of small producers are active in the market. Many of the producers offer healthy and ecologically friendly products, a strength of the well-preserved nature and well-developed agriculture in Tartu County and other areas in South Estonia.

The food industry in Tartu is mainly characterised by a few very big manufacturing companies like A. Le Coq, the largest producer of beverages in Estonia; Salvest, one of the largest food-canning industries in Estonia; Valio Eesti, one of the largest dairy companies in Estonia; and Nõo Lihatööstus, one of the largest meat products producers in Estonia. Yet, small companies like Luke Dairy Farm (the only moldy cheese producer in Estonia), Andre Farm (cheese) and Gustav (cakes and truffles), etc., are emerging and enriching the local food market.

2.2. Overview of the region in terms of R&D&I

Tartu is Estonia's leading centre of education and research. Tartu has 11 higher education institutions with a total of 16,400 students, conducting internationally recognized research and providing world-class research-based higher education. The University of Tartu is ranked in the top 2% of the world's best

universities. The second largest, the Estonian University of Life Sciences, is one of top 100 universities in the world in the field of agriculture and forestry.

There are five major research and innovation infrastructures in Tartu: Estonian Centre of Analytical Chemistry (ECAC), Estonian Centre for Genomics (ECG), Nanomaterials – research and applications (NAMUR)/Centre for Nano-Biotechnology and Microfabrication, Estonian Scientific Computing Infrastructure (ETAIS) and National Centre for Translational and Clinical Research (SIME). These major research and innovation infrastructures do not have any private sector involvement.

Four of these institutions are listed among the eight so-called core infrastructures of the state. Those infrastructures belong to the R&D institutions, were established in the public interest and can also be used by other persons based to the conditions and procedures established by the R&D institution. The main task of the core infrastructures is to serve the research community and entrepreneurs through providing expertise and analytical possibilities in various areas. Universities in Tartu are involved in all eight core infrastructures of the state.

Since the beginning of the 21st century, many ICT and other high-tech companies have set up business in Tartu. Tartu has been a trendsetter when it comes to ICT developments – talented minds and ambitious entrepreneurs have led to a rapidly growing ICT ecosystem which has attracted the attention of venture capitalists as well as foreign ICT companies.
Although Tartu is the hub of its county and South Estonia as a whole, and the formal targets to strengthen its RDIs, regional development and innovation strategies have materialized, the expected impact from those processes have not realized in terms of value-added services and products as well as employment.

In order to support sustainable growth in Tartu and South Estonia, linkages between the R&D institutions/RIIs as well as companies and skilled people have to be made. One of the main frameworks for this is the RIS3 strategy platform, where Estonia and Tartu have the same priorities. In 2014, Tartu Science Park in cooperation with the Centre for Applied Social Sciences published the smart specialization strategy of Tartu and South Estonia.

The four main growth areas are:

- ICTs and electronics;
- health technologies and biomedicine;
- wood (construction of wooden buildings);
- food (dairy industry and functional food).

The innovation system

Innovation is defined as “the successful transformation of creativity and knowledge into economic added value”. Until the end of the 20th century, Western Europe has been able to differentiate from other continents on productivity, flexibility and quality. Today innovation is THE leverage to create economic added value.

Estonia invested 1.5% of its GDP in the Research and Innovation in 2015. 46% of the Research and Development cost came from the state budget and it accounted 1.7% of the total government expenditure. Yet, Estonia has set a goal to spend 3% of the GDP on Research and Innovation by 2020, including 2% from the private sector.

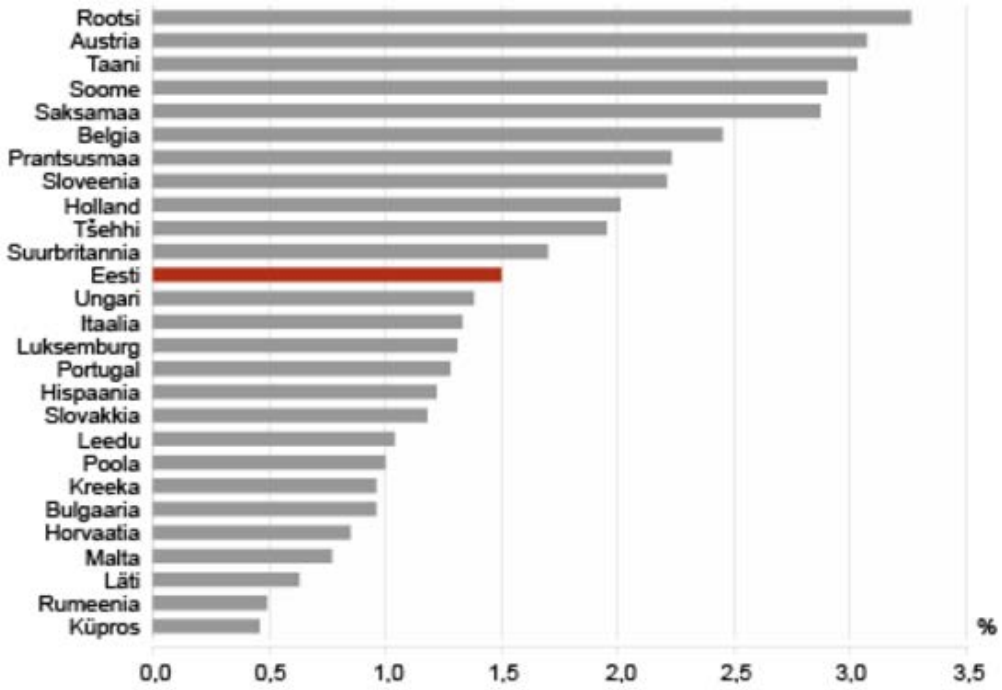
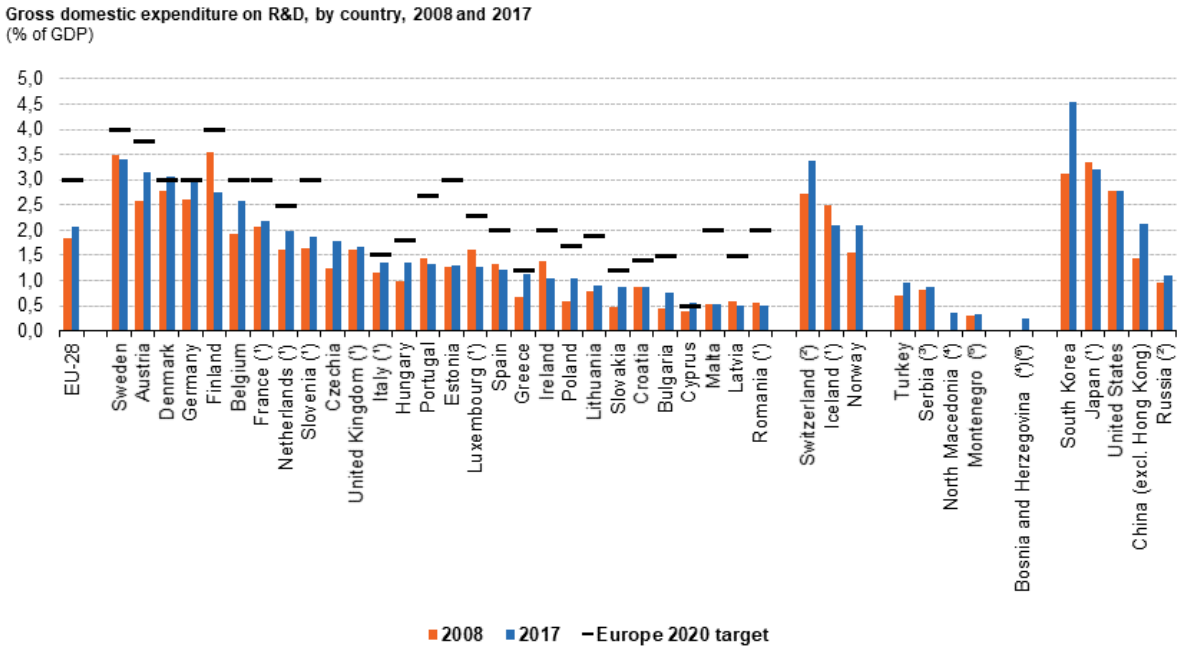


Figure 1. R&D expenditures in % in 2015. Estonia compared to rest of Europe

Flows of funding and incurred expenditures on R&D between sectors in indicate that the linkages between research performers and those financing researches are complex. And R&D expenditure statistics from various sources may be confusing to readers who are not familiar with the nuances of the statistical data. It is important to see who is funding research, and where this work is done and the expenditures incurred.



(1) Break(s) in time series between 2008 and 2017.
(2) 2015 data (instead of 2017).
(3) 2009 data (instead of 2008).
(4) No data for 2008.
(5) 2011 and 2016 data (instead of 2008 and 2017).
(6) 2014 data (instead of 2017).

Source: Eurostat (online data code: t2020_20)

eurostat

Figure 2. R&D expenditure dynamic in % of GDP in 2008 and 2017. Estonia, EU, and global powers

The main financier of R&D in Estonia is the government. Most of the funding provided by the government (90%) goes to research in the public sector, with approximately 10% allocated to the private sector. Likewise, private sector R&D financing tends to stay in the private sector, indeed even more so (94%). Only 6% of private sector R&D financing goes to fund research by universities and research institutes. Of the funds coming to Estonia from abroad (more than half of which come from EU Framework Programmes and less than half from private business contracts), approximately two-thirds go to the public sector and one-third to the private sector.

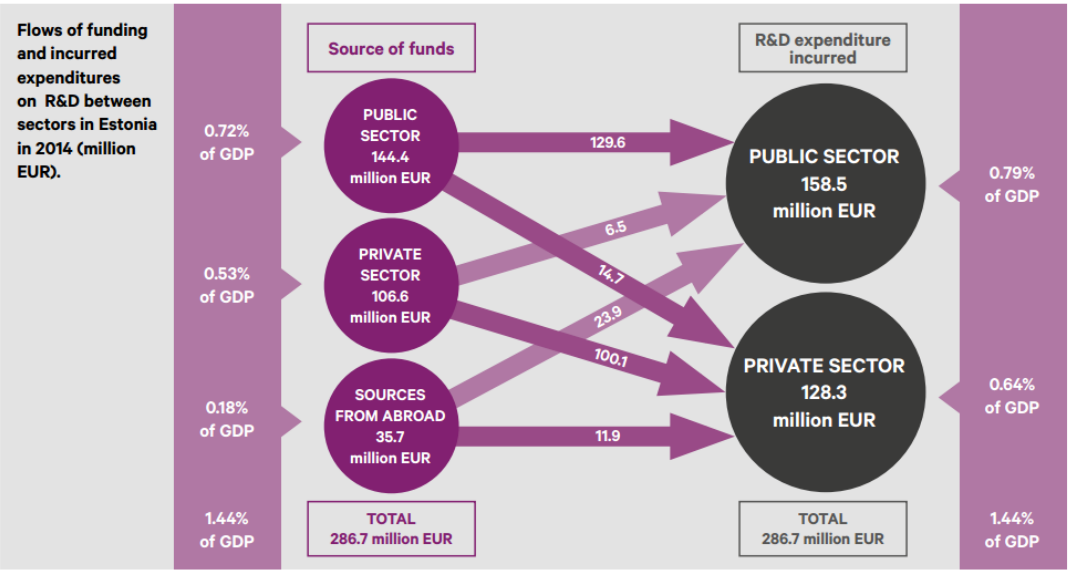


Figure 1.3. Flows of funding and incurred expenditures on R&D between sectors in Estonia in 2014 (million EUR).
Source: Statistics Estonia[10] and OECD[11], calculations by Estonian Research Council.

Figure 3. Flows of funding and incurred expenditures on R&D between sectors in Estonia in 2014 (million EUR). Source: Statistics Estonia and OECD, calculations by Estonian Research Council.

From a European perspective (Regional Innovation Scoreboard) Tartu/Estonia is a moderate innovator - region with a relative performance, as measured by the Regional Innovation Index, more than 10% below but less than 50% below that of the EU28 average[1].

[1] http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en

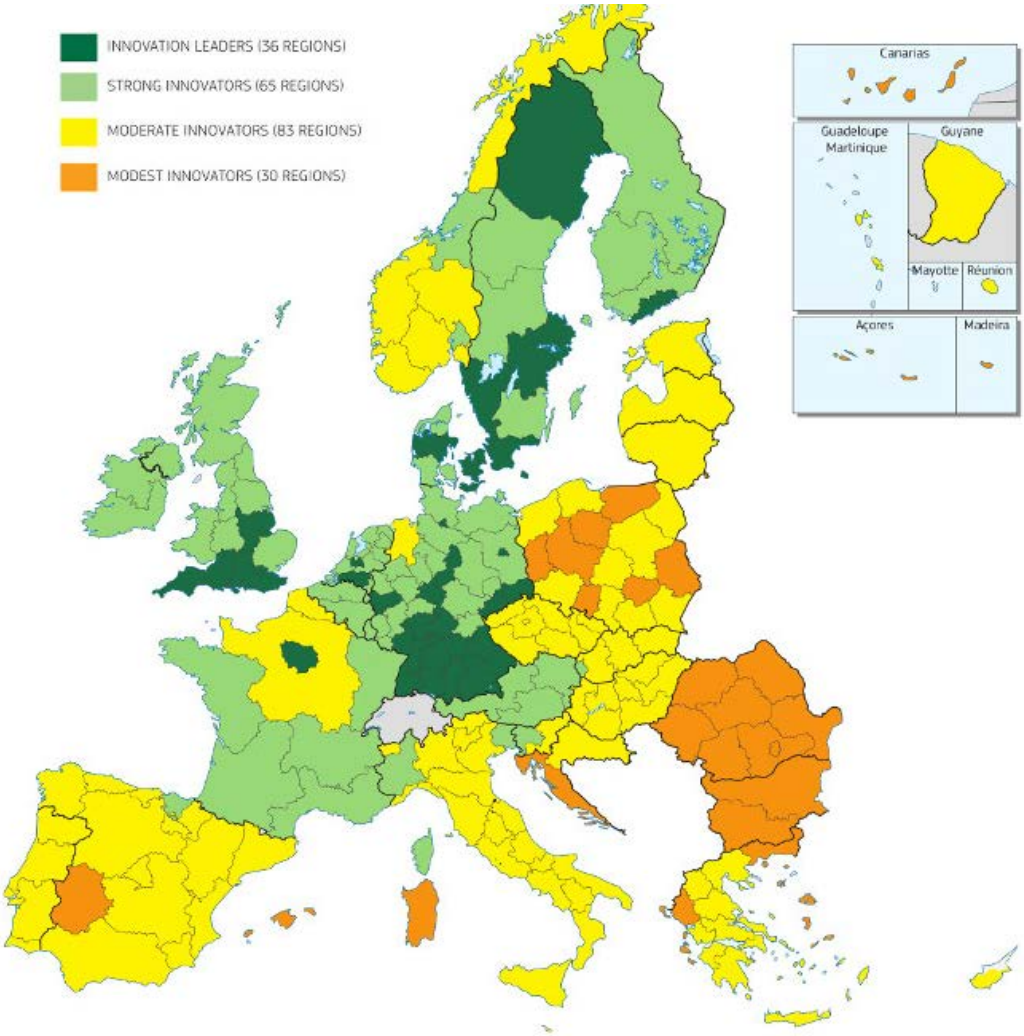


Figure 4. Regional Innovation Scoreboard data on the different regions in Europe

The institutions mentioned in the “The economy of Tartu” paragraph also form the business support ecosystem of Tartu as seen below. This community offers wide-range of different support, from incubation (Biotech, Creative Industries, Space) to Töötukassa (Estonian Unemployment Insurance Fund), Chamber of Commerce to infrastructure (Tartu Biotechnology Park, sTARTUp HUB, Tartu Science Park) and to Tartu Business Advisory Services.

Figure 1. Tartu business support ecosystem

Number of researchers (public and private)

The total number of researchers in Estonia, both in public and private organizations has rather decreased than increased over the years. Yet, despite the decreasing numbers, the personnel costs for R&D employees have increased 9% in total during the past years. The private sector wages rose by 18% and public sector wages by 1%.

R&D personnel	2013	2014	2015
Public sector			
- Total personnel	7517	7562	-
- FTE	3789	3998	3958
Private sector			
- Total personnel	2767	2930	-
- FTE	2069	1798	1636

Science & technology excellences

According to SJR - International Science Ranking, Estonian scientists submitted 2620 citable documents in 2015. That is 20.1 papers per 10000 inhabitants, which is a better result than Germany (16.4), Latvia (7.5), Italy (15.7), Czech Republic (19.6), but weaker than Sweden (35.8), Netherlands (30.3) and Belgium (25.8).

The Global Competitiveness Report of 2016-2017 released by the World Economic Forum ranks Estonia as a region, which is in the innovation-driven stage, at the top half of the charts in R&D, innovation and collaboration between industry, academic and governmental institutions. The rankings tell the tale, as Estonia is:

- 21st worldwide for quality scientific research centres;
- 35th worldwide for collaboration between industries and universities;

- 30th in Global Competitiveness Index;
- the 28th most innovative economy in the world.

Public RDI support schemes and main instruments

Stimulating RDI is one of the main topics covered by the Estonian politics. Estonia is committed to the European Lisbon-strategy and the Barcelona-target to increase the RDI spending to 3% of the GDP.

Research, development and innovation (RDI) have been national-development priorities, reflected in a relatively sophisticated set of policy instruments and in steady increases in RDI expenditure, which has reached the EU average level. However, recent evaluations also point to some weaknesses. The growth in public RDI expenditure has been almost wholly based on EU structural funds, while the volume of domestic revenues applied for this purpose has remained comparatively static. The majority of RDI resources are invested in producing research infrastructure without clear accompanying strategic plans for how to sustain the efficient use of buildings and equipment, or how to assess the potential impact of R&D projects on the country's socioeconomic development. Policy measures have been much more successful in developing scientific research, as indicated by an increased number of highly ranked international publications. Advances in the development of patents, high-tech products and services are noticeable but less prominent. One problem is that RDI measures have been focused on the top end of the economy, and the innovation system is consequently quite detached from the broad remainder of the country's economy. As a result, RDI output has not made a significant contribution to structural reforms of the economy. The second major problem is that RDI is treated as an objective in itself, and therefore remains only vaguely linked to the country's economic and social goals. R&D contracts with enterprises compose only 4% of the annual volume of universities' RDI budgets.

The main instruments are:

- **Applied research in smart specialisation growth areas – NUTIKAS**. The support aims to contribute to growth in the research-intensity of the Estonian economy, supporting collaboration between R&D institutions and companies. Furthermore, the support will help to raise the capabilities of R&D institutions to carry out applied research needed for business in smart specialisation growth areas.
- **Support for sectoral R&D – RITA.** It aims to support the pursuit of socio-economical applied research, guided by the needs of the Estonian state in order to increase the role of the state in the strategic steering of research and the capabilities of R&D institutions in carrying out socially relevant research.
- **Enterprise Development Programme.** Aims to support well-thought-out development, improved action planning, innovation implementation and product development. In the course of the development programme, each participating enterprise will launch new products and services that are more profitable than their predecessors.
- **Innovation voucher** - enables a small and medium-sized entrepreneur (SME) who is cooperating with a higher education institute, test laboratory, or intellectual property experts, to develop innovative solutions for development obstacles, carry out tests with new materials, gather knowledge on technologies, conduct studies in intellectual property databases etc.
- **Development voucher.** A supporting measure for preliminary research. The results of the development voucher should enable the entrepreneur to gain comprehensive knowledge on whether their development idea has the potential necessary for continuing the development process in other stages.
- **SME instrument** - The SME instrument is a measure which allows entrepreneurs to obtain financial support with the purchase of training and consultancy services.

- **Support for Research Infrastructures of National Importance**. Estonian Research Council has prepared the investment plan for „Research Infrastructures of National Importance“ based on the national research infrastructures roadmap. This activity is funded by the EU structural funds 2014-2020. It includes preparing the documentation for investment proposals, collecting and assessing the investment proposals. The total investment is 30 923 147 euros, of which the EU support covers up to 85%. The second call will be held after the Research Infrastructures Roadmap's update in 2017.

Important universities, RTOs and other research organisations in Tartu

Tartu is Estonia's leading centre of education and research. Human capital has served as the driving force of Tartu's growth over the centuries. Our well-functioning education system and high standard of R&D institutes are widely recognized.

Tartu has 11 higher education institutions, with a total of 16,400 students, conducting internationally recognized research and providing world-class research-based higher education. There are three higher education institutions with over 1,000 students—the University of Tartu, the Estonian University of Life Sciences and Tartu Health Care College.

The University of Tartu, founded in 1632, is one of the oldest universities in North-eastern Europe and is ranked in the top 2% of the world's best universities. The second largest, the Estonian University of Life Sciences, is one of top 100 universities in the world in the field of agriculture and forestry.

Since 2001, Tartu has been the seat of the Ministry of Education of Estonia. The research institutions of Tartu practically represent all the trends and fields of science in Estonia—Tartu is the base for five centres of excellence and three competence centres.

The main principles of R&D funding in Estonia are defined in the Organisation of Research and Development Act and all funding decisions are made on national level. The purpose of the Organisation of Research and Development Act is to provide the grounds for the organisation of research and development and to ensure legal means for the preservation and further development of scientific and technological creation as a component of Estonian culture and the Estonian economy.

The main instruments of financing Estonian R&D activities:

1. Baseline funding for R&D institutions. It involves the financing of R&D institutions with the aim of realizing strategic development goals, co-financing foreign and domestic projects and opening up new research directions. It is provided from the state budget.
2. Research grants are applied for in a public competition on the conditions and in accordance with the procedure established by the Estonian Research Council. The Council awards **research grants** to individual researchers and research groups.
3. Research and development programmes are launched and funds allocated by the ministry responsible for the implementation of the programme. Estonia has currently running two national R&D programmes:
   - Estonian language technology (2011-2017);
   - Estonian Language and Cultural Memory (2014–2018).

Through Enterprise Estonia and its sub-units, the Ministry of Economic Affairs finances R&D programmes that involve product development, co-operation with enterprises and entrepreneurs, and technology programmes for priority areas. Enterprise Estonia provides support for new companies as well as assistance to R&D activities of already active companies, NGOs and R&D institutions.

4. Infrastructure[2] expenses of a state R&D institution, which are not covered from ohter funding instruments, shall be covered from the state budget through the budget of the ministry under whose area of government the research and development institution belongs. The Ministry of Education and Research together with the Estonian Academy of Sciences have launched a process of compiling the Estonian roadmap[3] of research infrastructures. The roadmap is a long-term (10-20 years perspective) planning instrument, which lists research infrastructure units of national importance which are either new or in need of modernizing.
5. Researcher mobility support enables both Estonian and foreign researchers to carry out research in a new research environment to exchange experience, expand their co-operation networks and obtain new skills. The aim of postdoctoral grant is to support researchers with PhD degree or those with equivalent research qualifications to continue their independent research careers in strong collaborative research groups for up to three years. Researcher who has received his/her doctorate in Estonia cannot apply for a postdoctoral project at an Estonian R&D institution.

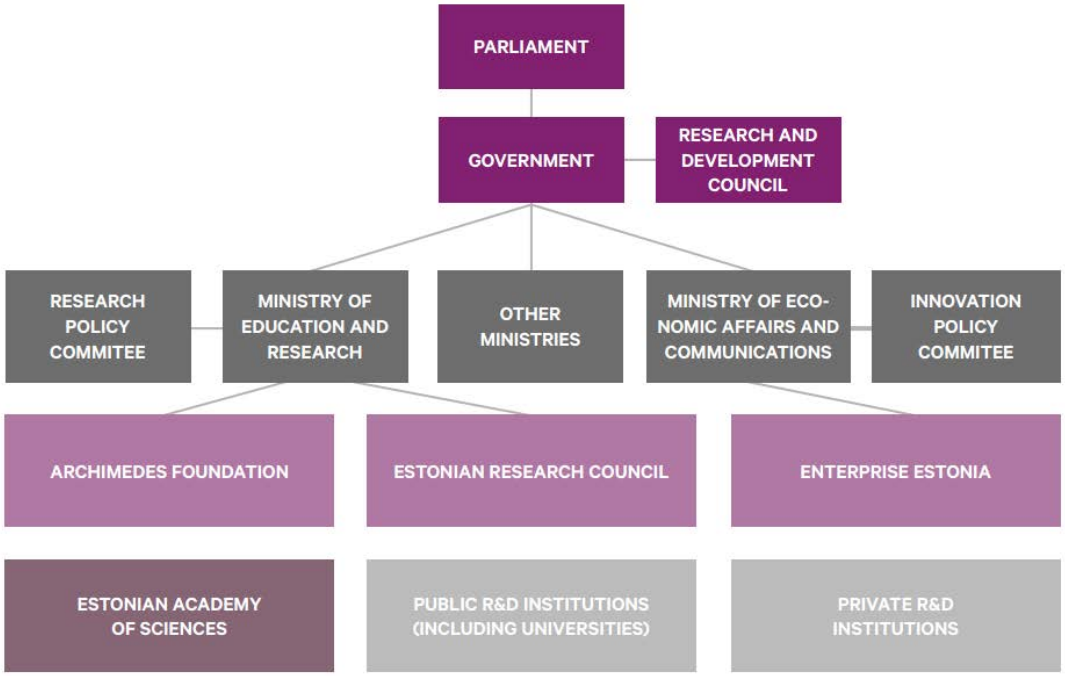


Figure 2. Estonian research and development organization structure, source Estonian Research Council

Estonian research and development institutions Twenty (20) research and development institutions have successfully passed regular evaluations. Among these are six (6) public universities: the **University of Tartu**, Tallinn University of Technology, Tallinn University, **the Estonian University of Life Sciences**, the Estonian Academy of Music and Theatre, and the Estonian Academy of Arts. Estonian researchers are mostly found in universities, where most of the research is done. The number of research institutions has decreased over the years, as many have become affiliated with universities. And in 2016, negotiations began to merge a number of state or public sector research institutions with universities. Public research institutions acting under the supervision of the Ministry of Education and Research include the **Estonian Literary Museum**, the Institute of the Estonian Language, **Tartu**

[2] http://www.etag.ee/en/funding/infrastructure-funding/

[3] http://www.etag.ee/en/funding/infrastructure-funding/estonian-research-infrastructures-roadmap/

Observatory and the **Estonian Biocentre**. Under the Ministry of Social Affairs is the National Institute for Health Development. Under the Ministry of Culture is the **Estonian National Museum**. Only one public research institute operates pursuant to a separate and independent legal basis, the National Institute of Chemical Physics and Biophysics. The Under and Tuglas Literature Centre operates under the Estonian Academy of Sciences.

Six private research institutions have successfully passed evaluations: **Cybernetica AS**, Protobios OÜ, Estonian Business School, Vähiuuringute Tehnoloogia Arenduskeskus AS (Competence Centre for Cancer Research), **Tervisetehnoloogiate Arenduskeskus AS (Competence Centre on Health Technologies), OÜ Tervisliku Piima Biotehnoloogiate Arenduskeskus (Bio-Competence Centre of Healthy Diary Products LLC). In addition, the Tarkvara Tehnoloogia Arenduskeskus OÜ (Software Technology and Applications Competence Centre) is located in Tartu.**

Centres of excellence in the period of 2015 to 2022 in Tartu are:

- **Ecology of global change: natural and managed ecosystems**
- **Advanced materials and high-technology devices for sustainable energetics, sensorics and nanoelectronics**
- **Centre of Excellence for Genomics and Translational Medicine**
- **Center of Excellence in Molecular Cell Engineering**
- **Center of Exellence in Estonian Studies**

Apart from the institutions mentioned above, there are Core Infrastructures. Those infrastructures belong to the R&D institutions and are necessary for carrying out the research themes, which were established in the public interest and which can also be used by other persons pursuant to the conditions and procedure established by the research and development institution. Core Infrastructures bring a high level of scientific equipment or technology and highly skilled manpower. Their main task is to serve research community and entrepreneurship through providing expertise and analytical possibilities in different areas. Currently there are eight Core Infrastructures[4]:

- **Center of Estonian Language Resources (CELR)** - This centre is a distributed interdisciplinary scientific research infrastructure for the development and application of modern analytical methods as well as the quality assurance of chemical measurements in research, surveillance and industry laboratories.
- **Estonian Center for Genomics (ECG).** In order to ensure the continuous development of genomics in Estonia, the Estonian Centre for Genomics (ECG) was created on the basis of the Estonian Genome Centre at the University of Tartu (EGCUT) and the Estonian Biocentre (EBC). The ECG includes a population-based biobank, the infrastructure necessary for genome research as well as scientific competence in statistics and bioinformatics. The partner of the ECG within the infrastructure of European biobanks and biomolecular resources is BBMRI-ERIC.
- **Estonian e-Repository and Conservation of Collections (e-varamu).** The e-repository research infrastructure will ensure the accessibility of the information resources which are stored and created at Estonian memory and research institutions and which are important for research, development and creative work. Three services will be developed: digitising collections, conserving these in physical format and making the information accessible via the e-Repository portal.

[4] http://www.etag.ee/en/funding/infrastructure-funding/core-infrastructures/

- **Estonian Environmental Observatory (KKobs) -** The Estonian Environmental Observatory is an integrated network of experimental environment stations developed jointly by Estonian research institutions. It covers the three main fields of environmental studies: 1. Atmosphere, Earth and climate studies 2. Biodiversity studies 3. Marine environment studies. The network of experimental research stations is a joint system of field laboratories and automatic stations representing different geographical and climatic areas in Estonia.
- **Estonian Scientific Computing Infrastructure (ETAIS) -** The Estonian Scientific Computing Infrastructure is a research infrastructure important on a national level in Estonia, providing Estonian researchers with access to vast computing and storage resources necessary for capacious scientific computing.
- **Nanomaterials – Research and Applications (NAMUR).** NAMUR is a multidisciplinary decentralized material research infrastructure in Estonia with the primary goal of: 1) providing world top level IR for material characterization at nano- and sub-nanometre scale; 2) make Estonia visible as a potential source of high level knowledge in the field of nano scale material science; 3) increase the knowledge and provide educational platform for nanoscale material science in Estonia.
- **National Centre for Translational and Clinical Research (SIME).** General objective of SIME is to advance medical research in Estonia by improving its quality and implementation. Mission of the SIME is to transform scientififc discoveries into innovative and high impact medicines, diagnostics and medical devices through collaboration between academia, industrial and governmental partners.
- **Natural History Archives and Information Network (NATARC).** A central infrastructure for natural history archives, consisting of storage facilities conforming to international standards, and necessary equipment required for the storage, research and recording of the collections in a database.

Furthermore, there are institutions mentioned in the Estonian Research Infrastructures Roadmap. It contains a list of new nationally important research infrastructure units, or of those in need of modernisation. The roadmap is an input to the investment decisions regarding research infrastructures. In addition, it is the task of the Estonian Research Council to coordinate the preparation and implementation of the roadmap objects and other large research infrastructures objects, and to monitor the realisation of the infrastructure objects. The institutions are as following[5]:

- **Estonian Centre of Analytical Chemistry (ECAC)**
- **Estonian Environmental Observatory**
- Plant Biology Infrastructure—From Molecules to High-Tech Agriculture
- The Optical Backbone Network of Estonian Research and Education
- **Estonian Scientific Computing Infrastructure**
- **ELIXIR Estonia—A Distributed Infrastructure for Life-Science Information**
- **Infotechnological Mobility Observatory (IMO)**
- **Estonian e-Repository and Conservation of Collections**
- **Estonian Centre for Genomics**
- **Center of Estonian Language Resources (CELR)**
- **Natural History Archives and Information Network (NATARC)**
- **Nanomaterials—research and applications (NAMUR) / Centre for Nano-Biotechnology and Microfabrication**
- **National Centre for Translational and Clinical Research**

[5] http://www.etag.ee/wp-content/uploads/2013/05/Eesti-teadustaristute-teekaart.pdf

- **Estonian Beamline MAX-IV at the Synchrotron Radiation Source**
- **European Spallation Source (ESSource)**
- **Estonia in the European Social Survey**
- **Estonia's Membership in the European Space Agency**
- Estonian Participation in the European Organization for Nuclear Research

(The institutions in bold are located in Tartu)

Introduction to RI infrastructures

Important RIIs

Depending on the definition and the specification of the RII's which are within scope of this project, in Tartu there are 5(major) research and innovation infrastructures which are worthwhile mentioning:

- **Estonian Centre of Analytical Chemistry (ECAC)**
- **Estonian Centre for Genomics (ECG)**
- **Nanomaterials—research and applications (NAMUR) / Centre for Nano-Biotechnology and Microfabrication**
- **Estonian Scientific Computing Infrastructure (ETAIS)**
- **National Centre for Translational and Clinical Research (SIME)**

The main areas RIIs cover

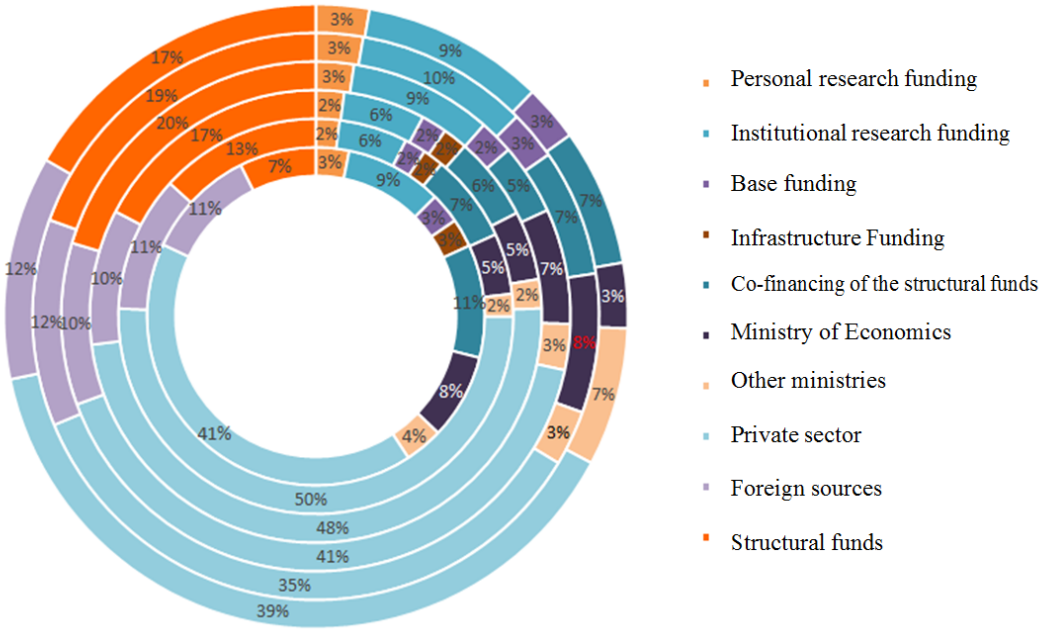
The main areas which are covered by the above mentioned infrastructures are:

- **Biotechnology**
- **ICT**
- **Advanced manufacturing on nanotech**
- **Nanotechnology**

Governmental support to RIIs

The RII funding scheme in general is shown under the "The innovation system" paragraph above. Yet, here are some percentages of the financing of R&D in Estonia from 2010 to 2015. (2010 is the most inwards circle).

R&D financing in Estonia from 2010 to 2015 (All)



Private sector involvement

The 5 major research and innovation infrastructures do not have any private sector involvments. Yet, there are some interesting partnerships. For example, The partners of the National Centre for Translational and Clinical Research are the University of Tartu, Estonian University of Life Sciences, and Tartu University Hospital Foundation. The main international partners are the European Institute for Biomedical Imaging Research (EIBIR), MRC Harwell Centre, King's College London, KarolinskaInstitutet and several other outstanding European research institutions.

There is private sector involvement in the competence centres like Tervisetehnoloogiate Arenduskeskus AS (Competence Centre on Health Technologies), OÜ Tervisliku Piima Biotehnoloogiate Arenduskeskus (Bio-Competence Centre of Healthy Diary Products LLC) and Tarkvara Tehnoloogia Arenduskeskus OÜ (Software Technology and Applications Competence Centre). The number of private partners in their Partners and collaboration network is 7, 2 and 11 respectively.

2.3. Smart Specialization Strategy - RIS3

Overall concise introduction of the RIS3 strategy of the region

After an in-depth analysis conducted by the Estonian Development Fund and supported by the Ministry of Education and Research, the Ministry Economic Affairs and Communication, Enterprise Estonia and the Estonian Research Council in 2013, the smart specialisation strategy was defined[6]. Although not recommended, the Estonia and also other Baltic states us the top-down approach – where the public sector determines narrow growth areas with administrative guidelines. This is mainly because of the small size of the regions and economy in general. Yet, several regions in Estonia, including Tartu (report from 2014[7]) as one of the pioneers, have defined their own growth areas.

[6] http://www.arengufond.ee/wp-content/uploads/2013/04/Estonia_Smart_Specialisation_Qualitative_Analysis.pdf
[7] http://www.teaduspark.ee/UserFiles/Materjalid/Strateegiad/LENSS%20starteegia%20VIIMANE_2014-06-07.pdf

Table 1. Main growth areas of RIS3 in Estonia and Tartu (including South Estonia)

Estonia	**Tartu and South-Estonia**
1. Information and communications technology (ICT) horizontally via other sectors; 2. Health technology and services 3. More efficient value-added from the use of resources	1. Information and communications technology and electronics; 2. Health technologies and biomedicine; 3. Wood (construction of wooden buildings); 4. Food (dairy industry and functional food)

Yet, although already 3-4 years old, the smart specialisation strategy of Estonia and Tartu is still at the stage of building the foundations for a strategic governance of priority setting and mutual commitment for smart specializations. This governance for identifying smart specializations is conceived as a bottom-up 'self-discovery process', guided by a challenge driven political and societal commitment that builds on strategic processes involving stakeholders in the past decade.

Smart specialisation is giving guidance to the development of the Tartu and South Estonian economic and innovation systems by a differentiation strategy based on comparative strengths. These were already found in a former study "Analysis of the competitiveness and growth areas for Tartu and South Estonia"[8] before the RIS3 strategy was created. Development of a smart specialisation strategy is therefore now part of the overall future strategy of Tartu and South Estonia and not only a response to the 'ex ante conditionality' of the European cohesion policy.

The development of the smart specialisation strategy is embedded in the course of our evolving policy and institutional frameworks. We see smart specialisation as a focus strategy for systemic changes at the level of economy, the innovation system and government.

The economic and social challenges the regional RIS3 strategy addresses

The smart specialisation strategy of Tartu and South Estonia will result from the interaction between priority setting in national, regional and micro level and from the "entrepreneurial discovery" processes. Also from the alignment to the interregional cooperation and European roadmaps for common challenges.

The South-Estonian economy has lost a large share of jobs in the primary sector over the past two decades of restructuring. However, the primary sector was swapped by with the secondary sector which has been focused on subcontracting and low labour cost. Yet, the advantage of the lower labour costs is rapidly disappearing.

Although city of Tartu is the hub for its County and for the whole South Estonia, and the formal targets to strengthen its RDIs, regional development and innovation strategies have materialized, the expected impact from those processes have not realized into value added and employment for the whole of South-Estonia.

In order to create a sustainable growth for the Tartu and South Estonia, linkages with the RIIs, universities and other institutions, as well as skilled people have to be made. And one of the possibilities to do it is through the RIS3 strategy platform, where Estonia and Tartu have the same priorities.

[8] http://www.teaduspark.ee/UserFiles/Projektid/CCIC/Tartu%20ja%20L%C3%B5una-Eesti%20konkurentsiv%C3%B5ime%20ja%20kasvualade%20anal%C3%BC%C3%BCs.pdf

Description of the smart specialisation focal areas of the region

In May 2014, Tartu Science Park, in cooperation with the Centre for Applied Social Sciences, published the smart specialisation strategy of Tartu and South Estonia[9]. Although this document was based on the prior analysis on the growth areas of the region and was in accordance with the national smart specialisation strategy, it can be considered to be the result of the policy evolution in Estonia after the reindependence and a completion of the strategic convergence of different policy domains, as the found growth areas in Tartu and South Estonia matched the ones selected in the national strategy. There were minor specifications under the "More efficient value-added from the use of resources" growth area, where two separate areas where indicated with the most potential. The four growth areas of the Tartu and South Estonia RIS3 are:

- **Information and communications technology and electronics;**
- **Health technologies and biomedicine;**
- **Wood (construction of wooden buildings);**
- **Food (dairy industry and functional food)**

Strategy to ensure accumulation of critical mass on Research Development and Innovation (RDI)

The quantity and complexity of problems facing a society are increasing across the world. Amongst a country's development objectives there is generally a priority to increase the competitiveness of the economy and to have a successful functioning of society, a high standard of living and an increase in the welfare of its population. The more successful countries invest heavily in education, RD and innovation, making efforts to increase the impact of research, to retain existing - and gain new - top specialists, and to ensure economic growth and the longevity of statehood and culture. In Estonia we must also again review our current activities and seek new ways to progress further. The more we achieve in our development, the more demanding we must also become towards our research policy.

In the last decade Estonian society and the economy have developed rapidly as a whole; as a result of the economic crisis, the structure of the economy is also changing. Ensuring further development requires increasing the attention paid to achieving a better position in the international value chain and to increasing the welfare of people living in Estonia.

Strategy documents determine the directions for the development of research and development and innovation. It is not only the basis for one of the most important and central fields of activity in Estonian society, but also how we can manage, in a more interconnected manner, where public financial resources can be better applied, and the competitiveness of the state and the welfare of the population can be increased. The strategy documents to promote knowledge spill over and technological diversification are:

- **Konkurentsivõime kava "Eesti 2020"[10] (in Estonian),**
- **Estonian Entrepreneurship Growth Strategy 2014-2020[11]**
- **Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2014-2020[12]**
- **RD&I strategy "Knowledge Based Estonia 2014-2020"[13]**

[9] http://www.teaduspark.ee/UserFiles/Materjalid/Strateegiad/LENSS%20starteegia%20VIIMANE_2014-06-07.pdf
[10] https://valitsus.ee/sites/default/files/content-editors/arengukavad/eesti2020_tekstiosa_2016-2020_03.05.16.pdf
[11] http://kasvustrateegia.mkm.ee/index_eng.html
[12] https://www.riigiteataja.ee/aktilisa/3290/1201/4002/strateegia.pdf#

[13] https://rio.jrc.ec.europa.eu/en/file/7618/download?token=GmfrrHTf

Figure 3. Links of the growth strategy with other development plans

The measures taken to stimulate RDI that are stated under the regional RIS3 strategy

The Estonian Research Council supports applied research in smart specialisation growth areas with the programme called NUTIKAS.

The support aims to contribute to growth in the research-intensity of the Estonian economy, supporting collaboration between R&D institutions and companies. Furthermore, the support will help to raise the capabilities of R&D institutions to carry out applied research needed for business in smart specialisation growth areas. The funding supports companies in commissioning necessary applied research or product development projects from universities or research institutions.

The volume of funding in a call for proposals is up to 9 million euros, the maximum volume of funding per project is 2 million euros, whereas the minimum amount is 20 thousand euros. The company contributes to the study with its own financing depending on the size of the company, and whether product development or an applied study is involved. Funding is applied for through open calls for proposals organised by the Archimedes Foundation. The Estonian Research Council is assisted by a steering committee that evaluates applications and oversees the support measure overall.

In general, all measures are defined on the national level and regions/regional governments do not have measures to support and stimulate RDIs financially. Yet, Regional governments can participate in different cooperation/good practice projects like Interreg Europe programme and take the initiative to support the regional RIIs.

In order to address the specific policy challenges of the region(s), policy makers can choose the set of instruments for their policy-mix that seem the most effective. The design of a coherent and effective policy-mix implies that regional policymakers are dealing with a high level of policy complexity. For instance, the combination of several policy instruments may create synergies but also weaken the success of individual instruments. Complex policy mixes can also create coordination failure as it requires the regional government to effectively coordinate multiple actors, and through multi-level governance (OECD, 2019).

Regions or cities can promote collaborations with universities and businesses by taking advantage of their history and brand, building cross-border networks, investing in local strengths and anchoring relationships through large firms. The combination of knowledge and innovation in the universities has created an increasing trend for the national and local decision makers to support the collaborations between universities and high-growth firms.

Europe has customised the smart specialisation strategy as a place-based policy, which should help the regions to grow their capabilities and increase European competitiveness in general. The core of the smart specialisation approach is the growth of competitiveness of the local entrepreneurship by combining their existing strengths with application of the key enabling technologies obtained through cooperation with different universities and research institutions (Foray 2016). It presumes the existence of absorptive capabilities from the side of local businesses. On the other hand, local universities and research institutions should also be able to provide requested knowledge about the use of key enabling technologies in these industries, which are relevant for the region (Kempton and Edwards 2014).

However, one of the prerequisites of implementing the smart specialisation strategy is that the regions possess necessary capabilities. As the key producers and holders of knowledge, universities play an important role in the regional smart specialisation processes. They form an important building block, creating the knowledge base of the regional, national and European economy. The most important factor for regional growth and accumulation of capital, knowledge and technology is the combination and involvement of universities, industry and government.
The discussion about the implementation of smart specialisation strategies is especially important in case of the catching-up countries from Central and Eastern Europe (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia), as there is a strong diversity in the structure of the national innovation systems, innovation performance (Radošević 2017) and university-industry collaboration support mechanisms (Seppo et al. 2014).

Furthermore, in terms of smart specialisation strategies, one of the most important aspects is entrepreneurial discovery. Policymakers must create a unique competitive offer and build capabilities in specific fields and they have to ensure that the strategy incorporates country and region-specific drivers. Foray states that ‘it is knowledge of “time and place”; this is local knowledge which is dispersed, decentralized and divided’ (Foray 2016: 1433). The decisions of wisdom and ‘ex ante’ knowledge about future priorities should be informed by the local knowledge, ‘of time and place’, and the entrepreneurial knowledge about opportunities, constraints and challenges (Foray 2016). This is because, according to Radošević (2017), what we can see today in practice is the lack of differentiation in approaches to smart specialisation and an excessive R&D or high-tech focus.

Knowledge about what elements are fuelling the university-industry cooperation in the region and what capabilities help the region and its actors to become more competitive are some of the key questions the policymakers are looking for an answer to. However, university-industry cooperation has not the full effect when there is no governmental support. Thus, knowledge creation initiated by the state is also one of the factors crucial for defining the suitable landscape for creation of capabilities.

The city of Tartu has done several initiatives in order to grow the regional capabilities. It is not only the city or local authority, but the city has been able to involve other regional and interregional stakeholders in order to support the entrepreneurship in the region. The support of the city regarding building the regional capabilities can be divided into three categories: financial instruments, regulatory instruments and soft instruments. Most of them do not directly support the university-industry cooperation; however, they provide a strong incentive.

Lilles et al (2018) brought out that the implementation of the smart specialisation strategy requires from the local firms abilities to combine their existing strengths with the application of the key enabling technologies such as information or material technologies obtained through the cooperation with the different universities and research institutions. It presumes the existence of absorptive capabilities from the side of local businesses and more generally requires well-functioning regional innovation systems.

Their article evaluated the potential of different EU regions to support university-industry cooperation as an important precondition for the implementation of the smart specialisation strategy. By using exploratory factor analysis on the set of EU regional (NUTS 1) level variables, three independent dimensions describing the potential of regions to support university-industry cooperation were found – the supporting role of the public sector, the supporting role of the private sector and the supporting role of universities. The obtained results open the very heterogeneous character of regions towards their ability to support university-industry cooperation. Many regions in the Central and Eastern European countries, but also some regions in Southern Europe do not seem to have enough supportive strength to be able to benefit from the smart specialisation approach.

The extremely unequal position of regions by their ability to support university-industry cooperation and to create a well-functioning Triple Helix poses a threat to the implementation of the smart specialisation strategy. It seems that threat could realise. This was acknowledged by Bonaccorsi (2009), who stated that the ‘Triple Helix may fail to materialise, particularly in less developed regions. In most cases, the three actors do not align their goals. They constitute separate corners of a triangle, not strains in a dynamically active helix’. The EU regional policies to allocate resources in a horizontal manner have not produced sufficient results. Although Europe tries to support the weaker regions through its policies, our results showed that they are lagging further behind. In many regions, there is little evidence of university-industry collaboration, as the actors and policies are too weak to set up the necessary preconditions for collaboration in regional space.

In order to benefit from the EU smart specialisation strategy, the following directions of improvements should be considered in the policy design and implementation.

Firstly, more attention should be given to the region (place) specific approach. The innovation process in EU catching-up regions, which often were among the lagging regions by our research, is largely based on the incremental innovation and adoption of existing technologies (Radošević 2017) rather than on heavy investment into R&D. Therefore, in the universities located within those weaker regions special attention needs to be given toward knowledge translation (diffusion) capabilities. It creates preconditions for the transmission of the knowledge produced in core regions and informs local firms about the existing opportunities to use key enabling technologies.

Secondly, it seems that higher priority should be given to the policies which motivate leading research universities in the core regions of Europe to cooperate with universities from the catching-up regions. It should be aimed to launch funding schemes to motivate the creation of a cooperation network (motivational approach) and to create regional universities in catching-up regions for stronger knowledge transfer capabilities (mission-based approach). In this respect, the experience of Nordic countries with regional universities has been a positive example (Hedin 2009), which could be followed.

Thirdly, an important direction should be the development of the regional level policymaking capabilities toward the support of university and industry interactions. This includes increasing their motivation, competence and networking capabilities to cooperate with the private sector and universities. This is crucial in order to eliminate or at least reduce the barriers which exist between universities and firms in these lagging regions. There is a portfolio of channels for knowledge transfer highlighted by several authors (i.e. Bekkers and Freitas 2008) that covers the possibilities to share the knowledge and create the linkages. For example, the Interreg Europe Policy Learning Platform could be used as a learning instrument to strengthen the supporting role of the public sector toward university-industry cooperation.

In conclusion, in order to benefit from the EU smart specialisation strategy, the very uneven potential of regions toward the university-industry cooperation needs to be considered in the process of its implementation.

3. The policy instrument

3.1. Overall description of the policy instrument

The selected policy instrument, the Development Plan of Tartu 2018 to 2025, sees Tartu as the intellectual capital of Estonia and the centre for promoting development in South-Estonia as a whole. According to the vision of Tartu 2030, the city is a “university town with traditions, a city of youth where creativeness and open reasoning support development activity and innovation in entrepreneurship, a city with modern urban environment, safe, developing, sustainable way of life and an actively cooperating Estonian city.”

The instrument will make considerable contributions to the development of Tartu’s innovation system in support of the regional economy. The instrument will support high-tech enterprises based in Tartu that are of great vitality. This also enables to address the development of smart entrepreneurship in Tartu region and create an attractive environment. The measure will address the improvement of linking industries important to the region's economy to centres of excellence and support structures, to research institutions and foreign networks.

Tartu Development Plan has similar goals which are brought in Estonian Growth Strategy for Entrepreneurship which includes in itself national RIS3 Strategy and its goals. It is also in alignment with other relevant national strategies such as Strategy for Research & Innovation and Regional Development Strategy. However, ties between municipal policy and the objectives brought in RIS3 and

Estonian Growth Strategy could be improved so that there would be synergy instead of fragmentation of approaches and resources. The local RIS3 strategy has already been brought out earlier in the document.

In 2019, Tartu city started tackling some of the points in the Development Plan of Tartu 2018 to 2025 regarding Research & Development & Innovation activities. Based on the context analyses, good practices, study visits, learning workshops, peer review meetings, etc. – the following **lessons were the most relevant** for Tartu City Government to tackle in the future:

- Low availability of quality human resources. Therefore, the effective management and coordination of available R&D&I activities and human resources is crucial. Although involving all relevant parties of the local ecosystem and aligning their goals can be difficult, it is of high importance for growth and development of the entire ecosystem.
- Human resources need to be trained better and existing resources need to be exploited better (i.e. awareness of existing platforms and programs must be raised) while at the same time avoiding duplication among seemingly similar events organized by the local ecosystem stakeholders.
- It is essential to form cross-regional contacts and collaboration channels
- Creation of new support measures for local SMEs, start-ups and university spin-offs in prototyping and applied research in order to remain competitive nationally and regionally.

Based on those topics, an action plan was created in order to have a more concrete vision.

Action 1. Organizing trainings to encourage entrepreneurship in education and research institutions.

Objective – to make researchers more open and willing to work with companies or start companies of their own, i.e. to change the mindset about entrepreneurship.

Background – Based on the analysis of different meetings, surveys etc, it became evident that several European regions struggle with the lack of entrepreneurial spirit among researchers and academic staff. It is something we all need to work on and there are possibilities to share the knowledge and organise joint activities regarding this topic.

Businesses and research institutions have different internal logics. Roughly put, businesses need quick positive results and are aimed at generating profits while research institutions are interested in research, i.e. the intellectual challenge and problem-solving side of things, whereas negative results are also valued. Intellectual property is also viewed differently – scientists want to publish research results while businesses want to protect the business secrets for their financial gain. While businesses want quick solutions/services from RDI institutions, they need more well-defined problems from businesses to offer optimal solutions. The different functioning logics can create the feeling that their procedures are

incompatible and communication errors between the two are easy to occur. Furthermore, existing stereotypes make the cooperation between the two even more difficult as neither side wants to go through a potentially risky process. This is also closely linked with the general fear of failure and lack of trust in the Estonian business culture.

Trainings in knowledge transfer, entrepreneurship, foreign markets etc. are the key to nurture a more entrepreneurial mind-set and reduce the stigma related to university-industry cooperation and differences in their cultures in Estonia. Tartu Science Park works closely together with Tartu City and other stakeholders of the ecosystem to organise and focus on supplying such trainings to generate more traffic between RDI institutions and industry and grow future entrepreneurs from talents working for research organisations.

Action 2. Promoting the use of already existing funding opportunities and cooperation platforms among research institutions and businesses.

Objective – to exploit available resources (programs and platforms) in terms of start-up, RDI institutions, and industry cooperation and cross-border initiatives.

Background – Different national support programs (e.g. Enterprise Estonia), EU cooperation platforms (e.g. EEN) and programmes (Watify, Est-Lat, Horizon 2020) and Tartu support networks (ADAPTER network, Ärinõuandla) are already there, but they are not used enough by start-ups and companies.

Through stakeholder meetings and interviews it became evident that although there are many support programs out there, businesses and start-ups are not always aware of them. Even though all the information is public, enterprises sometimes struggle to reach or find relevant information for them. This might be cause of information overload or limited time resources to go through multiple homepages. Therefore, there is room for more awareness raising and encouraging participation in the existing schemes.

Action 3. Encouraging international communication and cooperation among research institutions and businesses.

Objective – to enhance regional innovation cooperation.

Background – Based on the analysis of different meetings, surveys etc, it became evident that there is indeed potential for cross-regional cooperation. Thanks to the different EU projects, there is now potential to find new partners and engage other associated organisations of the ecosystems as it is much easier to facilitate cross regional cooperation through the personal connections already formed. Follow-up F2F meetings between the regions can therefore help to facilitate tighter cooperation.

However, regional similarities also need to be taken into account. Some regions have more in common and therefore have more potential for cooperation (either in terms of similar industrial setup or proximity).

Study visits in general are seen by stakeholders as very effective means for facilitating cooperation and transferring know-how. Using prior connections of the Tartu City and other institutions makes it easier

for others to get to the people of interest in other regions. Practice elsewhere has shown that study visits are also good means to breaking communication barriers between different players in the local ecosystem and facilitating cooperation between businesspersons and scientists.

Action 4. Conducting feasibility studies for setting up SME support funds

Objective – to identify the most effective means for supporting SMEs in their early stage development and TRL levels 4-7 in Tartu.

Background – Tartu is on par with scientific research and development on technology readiness levels (TRL) 1-3. Local incubators and support structures are also in place in Tartu for enhancing growth on TRL levels 8-9. However, what is crucially missing, is the link between the two. There is a lack of funds and measures that would help businesses with technology development and demonstration, i.e. TRL levels 4-7. In January 2020 Tartu Science Park and University of Tartu launched programme Science to Business where University of Tartu provides proof-of-concept funds to deeptech and knowledge-intensive teams (TRL 2-4) and projects as well as pre-incubation activities via its Entrepreneurship and Innovation Centre. Tartu Science Park offers its S2B Launchpad incubation programme to develop deeptech ideas further from TRL 4-7 with an aim to bring them (closer) to the market. Tartu City Government is funding TSP's incubation programme with 40 000€ during 2020 to boost its impact.

These feelings were repeated in the conducted interviews with local stakeholders: there is no available funding for the proof of concept and prototyping phase in business development. This is seen as a major issue. Too many ideas fail in early stages, as they do not reach the development phase. This means that scientific knowledge created in the university and in RDI institutions do not reach commercialisation. This is also a competitiveness issue as other regional universities (e.g. Turu, Uppsala, Helsinki, Karolinskaja) have better funding for encouraging entrepreneurship among academic staff.

An additional issue that became evident is that some existing funding schemes (e.g. offered by Enterprise Estonia and the Estonian Research Council) have too demanding requirements on own contribution/funding which again hinders early stage development of local start-ups.

3.2. Design of the policy instrument

When planning the activities of the development plan, Tartu City kept in mind the main goal - to improve the quality of life of the citizens and to make Tartu more attractive to both investors and visitors to the city.

Many experts with various backgrounds, representatives of non-governmental organizations and city dwellers interested in the good development of Tartu participated in the process of compiling the development plan.

The timeplan for the Development Plan process:

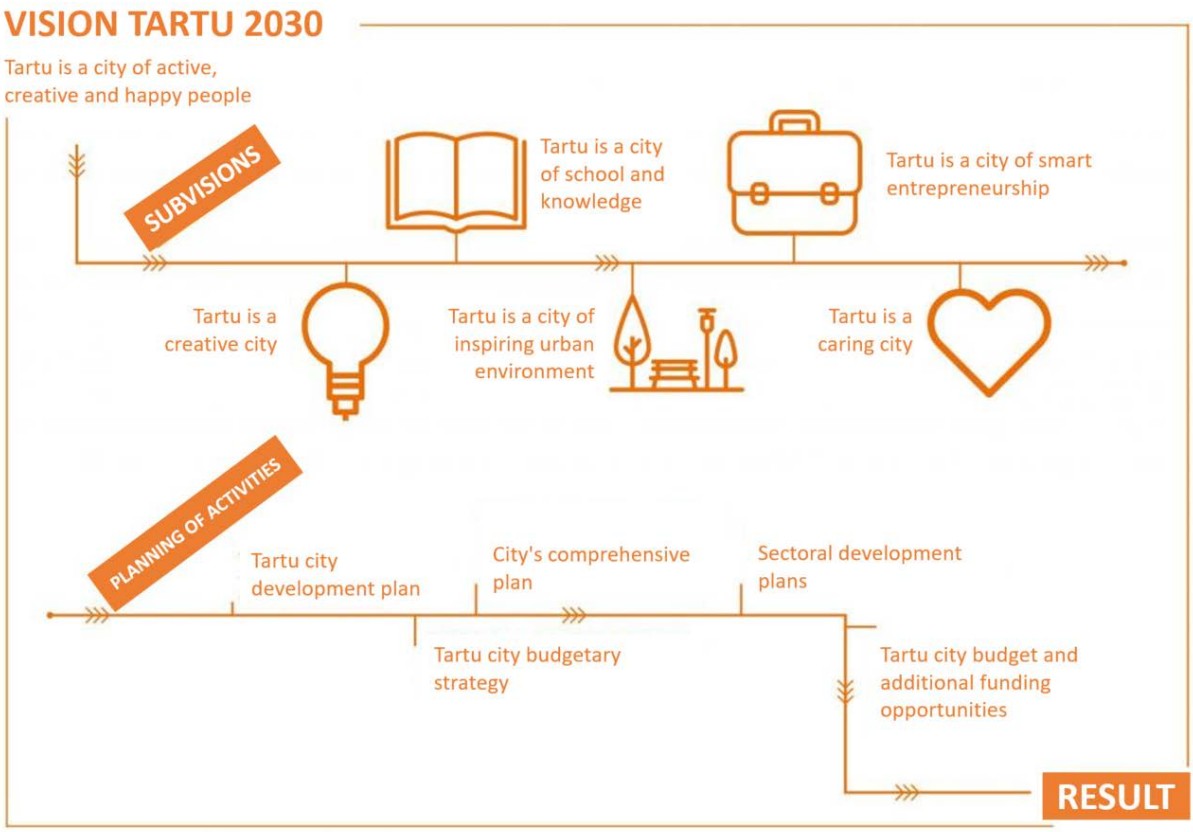
- April 14, 2016 - Decision of Tartu City Council on initiating the preparation of the Tartu City Development Plan 2018–2025
- May 27, 2016 - Development Plan Steering Group Meeting.
- August 26, 2016 - Tartu City Government brainstorming. Members of the steering group for the preparation of the development plan and specialists from the city government departments participated.
- 7.-31. October 2016 - survey of city residents. During the month, 97 Tartu residents answered the questionnaire, and a third of them left their contacts with the wish to continue participating in the development plan preparation process. This time the number of respondents was significantly higher than two years ago, in the survey conducted in 2014 within the framework of the review of the Tartu 2030 development strategy.
- November 23, 2016 - discussion with city residents. Respondents to the Tartu website survey, representatives of district associations and NGOs were invited to the discussion. It was discussed what are the most important problems that need to be addressed in the period of the new development plan - in 2018–2025.
- December 14, 2016 - seminar on culture, sports and youth work. In addition to the specialists of the cultural department of the city government, representatives of sub-agencies and target groups are invited to the seminar.
- February 2, 2017 - seminar on inspiring urban environment.
- February 6, 2017 - seminar on welfare and health care.
- February 9, 2017 - seminar on educational topics.
- June 28, 2017 - Tartu City Council approved the draft Tartu City Development Plan 2018-2025 and directed it to public display. See council decision.
- July 3 - September 10, 2017 - Tartu City Development Plan 2018-2025 at the public display.

At its meeting on 28 June 2017, the Tartu City Council approved the draft Tartu City Development Plan 2018–2025 and the budget strategy 2018–2021 and directed it to public display.

During the public display, all interested parties had the opportunity to express their opinion on the development plan and budgetary strategy and make further proposals. The public exhibition took place from July 3 to September 10, 2017.

During the public display, a total of 45 proposals for the development plan and budget strategy were received from eight persons and organizations, on the consideration of which the city government took a position at the meeting on September 12, 2017. The city government decided to support the inclusion of 16 proposals in the development plan.

The development plan is part of the Development Strategy Tartu 2030.



3.3. Policy mix ingredients

City of Tartu's vision is to have viable and high value-added companies. To achieve this, it is necessary to cooperate with higher education institutions, companies, research and development institutions, educational institutions, professional associations and business support structures.

The vision is being implemented via creating the suitable investment environment so that Tartu becomes the best place in Estonia to do business and start your business. Tartu wants to increase its reputation as a year-round tourism and holiday destination and to secure its position as a tourist magnet for Southern Estonia.

During the period of the development plan (2018-2025), the priority topics in the field of entrepreneurship are the promotion of job creation, the promotion of the internationalization and export of entrepreneurship, the attraction of talents to Tartu and the increase of entrepreneurial activity.

Development Plan of Tartu 2018 to 2025 is a regional plan without any direct ERDF linkage. The activities of implementing the entrepreneurship topics is being done in cooperation with other business support organisations. Those are listed in the section 3.4.

3.4. Map of the policy mix

In the next table, Tartu is a city of smart entrepreneurship section of the City Development plan is brought out. The table is dividend into three sections: Activities, Description and partners/stakeholders who help to implement those activities in Tartu.

Activity	Description	Partners (if in addition to city)
Developing the capacity of business to innovate and grow		
1. Ensuring a favourable growth environment for start-ups, including the development of incubation centres.	Tartu City Government supported the Tartu incubation centers both by involving them in various joint projects (incl. round tables for exchanging information, study trips for developing the contact network and gaining foreign experience, the community leader's planned joint incubation program) and financially.	Tartu Science Park, Tartu Centre for Creative Industries, Buildit Creative, SPARK Demo Centre, Tartu Biotechnology Park, sTARTUp Day business festival
2. Introduction of new technologies and scientific achievements and support for technology transfer	In addition to the work of business support structures, companies and universities to raise innovation awareness, the City organized several seminars and trainings in cooperation with partners, including MobileMonday seminars, Tartu Entrepreneurship Week, study visits to R&D institutions (Estonia and abroad), information sharing through Inno Infra Share and other projects etc. Tartu business support structures will also be supported in order to intensify cooperation and communication between research and development institutions and companies.	MobileMonday, University of Tartu, Estonian University of Life Sciences, Tartu Science Park etc
3. Development of investor services	Information on business opportunities in Tartu and Estonia is shared by hosting foreign delegations, introducing the SPARK demo center and within the framework of international business projects. Since May 2015, Tartu Business Advisory Board has been engaged in bringing foreign investments to Southern Estonia in a targeted manner.	Tartu Business Advisory Board, SPARK Demo Centre
4. Development of creative industry	Tartu Centre for Creative Industries is the leader in the development of the creative economy. They offer an incubation programme and organise events like Estonian Fashion Festival, different trainings and seminars, incl. hackathons	Tartu Centre for Creative Industries
5. Encouraging the emergence and development of economic clusters and business networks	The city has supported the formation of several cluster initiatives and is ready to promote the development of clusters formed on the initiative of companies. Several companies and research institutions participate in the work of clusters established elsewhere in Estonia.	

6. Creating and introducing opportunities to attract local and international talents to Tartu and / or to encourage them to stay here	Tartu Welcome Centre is a organisation with the mission of supporting foreigners in the process of settling in.	University of Tartu, University of Life Sciences and the Ministry of the Interior, Tartu Welcome Center
7. Supporting research-intensive businesses	In order to promote the development of research-intensive businesses, the activities of incubation centers dealing with the research-intensive topics will be supported	Tartu Science Park, Tartu Biotechnology Park, University of Tartu
8. Encouraging the adoption of digital solutions in companies	City started accepting applications for digitization support (manufacturing companies). Furthermore, activities regarding the uptake of digitalisation and Creation of Digital Innovation Hub are being done.	Tartu Business Advisory Board, Institute of Computer Science of the University of Tartu
Human resource development		
9. Organization of trainings and events related to entrepreneurship and advisory services for entrepreneurs	Activities regarding increasing entrepreneurial activity in Tartu - Entrepreneurship-related trainings and events, business idea competitions etc	Tartu Science Park, Tartu Centre for Creative Industries, SPARK Demo Centre, Tartu Biotechnology Park, sTARTUp Day business festival, Tartu Business Advisory Board, University of Tartu, University of Life Sciences, etc
10. Developing entrepreneurship education in schools and encouraging the creation of student companies	Supporting the stimulation of entrepreneurship of young people and the creation of student companies. Several conferences, competitions, fairs, information days and other events	Tartu Business Advisory Board
11. Encouraging students' entrepreneurship and work practice and recognizing student work related to Tartu entrepreneurship	Organisation of several seminars and trainings aimed at developing the entrepreneurship of young people, including students, including within the framework of Tartu Entrepreneurship Week	University of Tartu, University of Life Sciences
12. Development of career counseling	Tartu Vocational Education Center (KHK) is the largest vocational and in-service training center in Estonia belonging to the city of Tartu.	Tartu Vocational Education Center

13. Popularization of technical education	Development of human resources via vocational training several fields.	Tartu Vocational Education Center
14. Development of co-operation between schools and entrepreneurs providing vocational education		Tartu Vocational Education Center
15. Mentoring support	Organisation of a mentoring club for start-up entrepreneurs and a mentoring program for student companies	Tartu Business Advisory Board
16. Improving employee service skills	Organisation of a competition in order to draw attention to customer service and service providers, to promote the principles of good service and to value the profession of service provider	
Development of business support system and infrastructure		
17. Participation in the management of local business support institutions and support for their activities	The City of Tartu cooperates with all business support structures and other stakeholders operating in Tartu. The representatives of the city participating in the councils of the various organisations. Organisations of roundtables and study visits.	Tartu Business Advisory Board, Tartu Science Park, Tartu Centre for Creative Industries
18. Participation in the development of national policies and strategies and development plans affecting entrepreneurship	Participation in the development of policies and development plans affecting Tartu	Ministry of Economic Affairs and Infrastructure, Entreprise Estonia
19. Organizing a business surveys	Organising a business survey in every 5 years	
20. Supporting the development of the infrastructure of business support organizations	Allocating investment support in the organisations belonging to Tartu city	
21. Encouraging the development of transport connections	Finding possibilities to improve connectivity to other countries (i.e. via supporting airlines)	Finnair
22. Development of industrial parks and	Development of plots and other infrastructure for entrepreneurs	

planning of suitable areas for business		
Supporting the internationalization of business		
23. Supporting the participation of companies in major fairs	Supporting the entrepreneurs to attend international trade fairs	
24. Organization of international conferences	Supporting the organization of international conferences and events in Tartu. Support scheme for international conferences held in Tartu	sTARTUp Day
25. Involvement of entrepreneurs and business support structures in international projects and in the composition of city delegations	Participation in international cooperation projects	
Promoting the image of the business environment and the entrepreneurial culture		
26. Introduction of Tartu business and business environment	Information about Tartu and Estonian business opportunities is constantly shared through various information channels. Creation of different booklets and videos.	SPARK Demo Centre, Tartu Business Advisory Board
27. Development of a demo center for products and services of Tartu companies	Establishment of the Tartu Demo Center with the aim to, among other things, help entrepreneurs develop services that support internationalization.	Tartu Science Park
28. Organizing Tartu Entrepreneurship Week	The aim of Tartu Entrepreneurship Week is to develop people's entrepreneurial attitude and favourable attitude towards entrepreneurship and to encourage entrepreneurs with growth potential to act.	
29. Annual recognition of the best entrepreneurs, promotion of business ethics and promotion of socially responsible entrepreneurs	The Entrepreneurship Competition has been running since 1998 and aims to recognize the best entrepreneurs	sTARTUp Day, Tartu Business Advisory Board, Tartu Science Park, Tartu Centre for Creative Industries, Tartu Biotechnology Park, Tartu Vocational Education Center, University of Tartu

30. Organizing sTARTUp Day	Co-organisation and co-financing of sTARTUp Day business festival	sTARTUp Day
31. Use of Tartu's business and research potential for the development of the city	Participation in different projects, i.e. data analysis project related to data collected during the Metallica concert in Tartu. Collection of business-related data (i.e. card payment information, mobility, environment, parking etc.)	

3.5. Budget

The financial resources planned for the implementation of the activities are based on the personal income tax revenues as one of the foundations of the City's budget.

Thus, there is no fixed budget for period of 2018-2025, and it is rather a flexible budget based on the activities and current priorities in different fields.

Valdkond	2018 täitmine	2019 eelarve	2020 eelarve	muutuse %	2020-2019 eurodes
Ettevõtluse osakond kokku	**1 305 541**	**1 620 746**	**1 510 736**	**-6,8**	**-110 010**
Põhitegevuskulud	**1 209 416**	**1 504 921**	**1 425 736**	**-5,3**	**-79 185**
Üldised valitsussektori teenused	190 223	190 071	190 473	0,2	402
Majandus	1 019 193	1 314 850	1 235 263	-6,1	-79 587
Investeerimiskulud	**96 125**	**115 825**	**85 000**	**-26,6**	**-30 825**
Majandus	96 125	115 825	85 000	-26,6	-30 825

The total budget for entrepreneurship activities has been in the region of 1.5 to 1.6 million euros per year. In the 2020 example, this includes the general government services part of 190 473 euros. The financing budget (budget used to buy services from other business support organisations for activities that are not reasonable to organise itself) is divided into three groups:

1) financing budget of 898 623 euros
2) budget for tourism activities 293 000 euros
3) management budget of 128 640 euros

In addition, the City has investment costs in the sum of 85 000 euros for the repayment of bank loans and interest taken for the development of the Tartu Science Park Foundation.

Financing budget has been created in order to achieve the goals of the City brought out in the section 3.4. Grants are planned for:

Sum	Organisation	Description
225 391€	Tartu Centre for Creative Industries	125 391 for operating support (incl. 100,000 euros for operating support, 13 391 for incubation activities, 12 000 euros for trade fair visits) and 100 000 euros for support from the film fund
138 000€	Tartu Science Park	for operating support, including 48,000 euros to cover the operating costs of SPARK Demo and 50,000 euros for the development of the European Space Agency's business incubator and 40,000 euros for the development of business incubation services;
80 000€	sTARTUp Day	to organize the business festival sTARTUp Day and for start-up ecosystem activities;
60 000€	Various companies	for the promotion of the digitization of industrial enterprises in accordance with the procedure established by the council
32 000€	Tartu Biotechnology Park	for incubation activities
20 000€	Tartu Business Advisory Board	for operating support
20 000€	MTÜ Eesti Moe Festival	for organizing a five - day fashion event
7 000€	Ajujaht	to support an innovative business idea with the highest applied value
19 000€	Various companies	for small projects applying to funding

3.6. Governance

Chapter 3.2. “Design of the policy instrument” covered the primary stakeholders and the timeline of compiling the policy instrument. Policy instrument is mostly comprised of actions which city government either directly implements by itself or has ability to influence the implementation process through affiliated parties. For example, NGOs and Foundations where city government acts as one of founders or board members. Policy instrument governance involves primarily city governments own resources, but key focus has been placed also on collaboration with regional stakeholders.

Main responsibility lies within city government who annually reviews fulfilment of development plan and makes adjustments where deemed necessary. This is done by task force which is formed and led by Mayor and involves representatives of all city government's structural units. This review is basis for analysis and plans for next year. Budgeting strategy for policy instrument operates in four-year scale. It means that at each annual review budgeting strategy of policy instrument will be prolonged and updated by 1-year period.

Report of policy instrument's annual review is presented by task force to City Council together with Annual Economic Report once per year. Respective report and prolongation of policy instrument's budget by one year must be approved by City Council.

Each strategic challenge and goal in policy instrument is looked individually and has a different set of relevant stakeholders. For education it involves representatives of academia and local vocational education institutions, for entrepreneurial activities it involves business support organizations etc. Frequency of meetings between stakeholders and city government representatives to discuss policy instrument is flexible and up to task force to decide. Such meetings and round tables take place at least once per year. Practice from recent years shows that on average relevant institutions meet 2-4 times per year with an agenda focused on policy instrument.

Dedicated effort to involve citizens and local ecosystem more has been made during recent years with introduction of inclusive budgeting, revised system for applying for funds from city budget and regular, strategic goal specific, roundtables.

Below are brought stakeholders, list is not complete, who are involved partially in governance process by being partially or fully responsible of actions listed in policy instrument:

Business support organizations: Tartu Science Park, Tartu Biotechnology Park, Tartu Creative Industries Centre, Buildit Accelerator, Tartu University Idealab, Contriber Labs.

Start-up community promoter and leader: NGO Startup Day.

Tartu Business Advisory Services Foundation acts as a regional extension to Enterprise Estonia and Ministry of Economic Affairs and Communication.

University of Tartu / Estonian University of Life Sciences / Tartu Art College – these are three of in total eleven higher education institutions located in Tartu

3.7. Monitoring, assessment, evaluation

While policy instrument covers seven-year period and establishes priorities and guiding principles for mid-term time frame, it is being monitored and assessed continuously on annual basis or if need arises, more often.

Policy instrument covers prioritized activities and investments in upcoming years which are partially or fully coordinated and funded by city government from city budget. As mentioned in previous chapter, budgeting strategy of policy instrument refers to four-year timeframe which is reviewed on annual basis by task force led by Mayor of city. Policy instrument, its goals, and its annual review serves as one of foundations for compiling next years city budget.

Annual review of policy instrument looks at fulfilment of result indicators and strategic goals. Where necessary adjustments and changes are proposed. Report of policy instrument's annual review is presented by task force to City Council together with Annual Economic Report once per year. Respective report and prolongation of policy instrument's budget by one year must be approved by City Council.

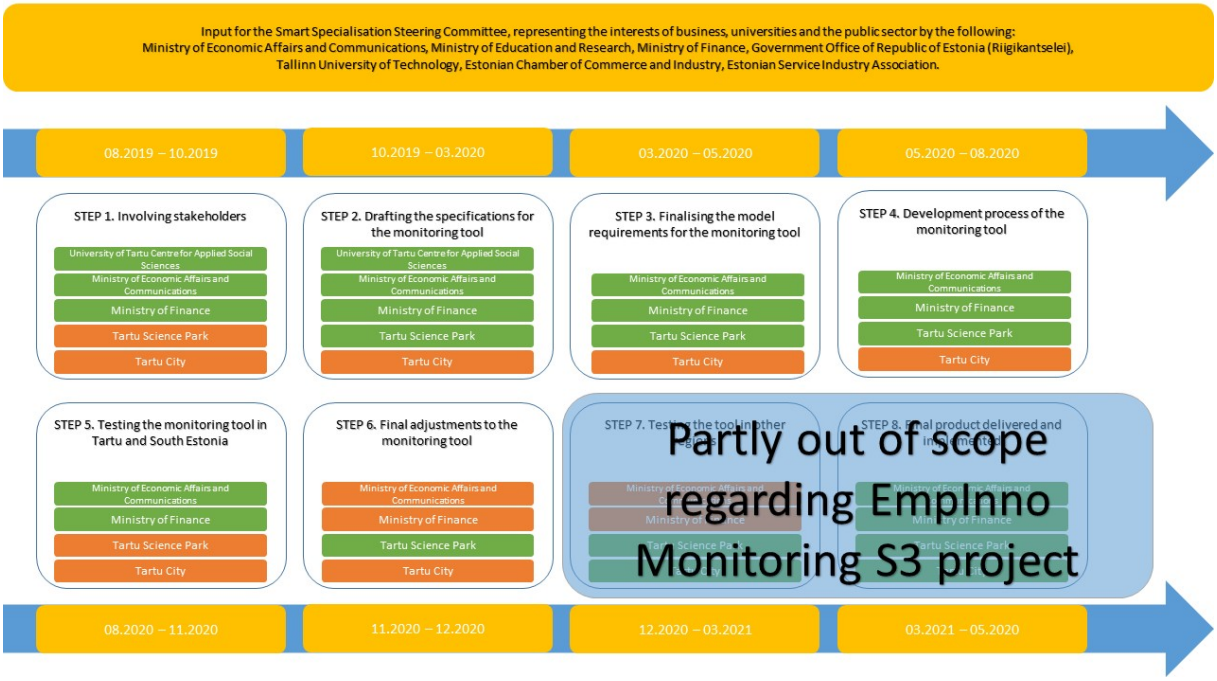
Long term cohesion and alignment with relevant national and local policy documents is analysed separately. Basis for this analysis are development indicators and their desired goal levels brought in more generic development document "Development Strategy Tartu 2030".

Additionally, different surveys are made with five-year cycle to study citizens satisfaction with different areas of life in region. Last such study "City of Tartu and citizens of Tartu" was conducted in 2018. Next study will take place on 2023. Survey dedicated to environmental issues "Citizens of Tartu and environment" will take place on 2021. Basic economic indicators (number of employees, turnover, export turnover, paid labour taxes) of businesses registered in Tartu are reviewed on annual basis.

Policy owner has recognized relevance of improved monitoring and evaluation during recent years. Task force has found that increased focus on the smart specialisation strategy would be beneficial as well as setting up local and regional support mechanisms and grants which are based on the logic of entrepreneurial discovery process. To achieve this, there should be set up interactive platforms for continuous monitoring of the development of growth areas and for cross-sectoral agreements. The definition of growth areas should be more flexible, and the measures should be less regulated. This will ensure greater compliance with the needs and specificities of the growth areas. The broader focus of smart specialisation should be on projects, initiatives and development processes that seek to speed up the development of businesses in growth areas and increase their added value and exports.

Department of Entrepreneurship is currently developing new monitoring tool in collaboration with Tartu Science Park and other actors for monitoring regional RIS3 growth areas. Tool is designed with an aim to serve wider purpose: to enable better monitoring and evaluation of knowledge and technology intensive enterprises to boost creation and growth of "smart" workplaces. It would be integral element

and input source for policy instrument discussed in this report. Scheme below illustrates the timeline and stakeholders involved of this tool.



For monitoring and evaluating R&D&I activities within policy instrument separate methodology has not been worked out to date.

During 2019-2020 discussions between policy owner and relevant actors have led to conclusion that monitoring of key areas, including R&D&I activities, should be based on the multi-stage analysis, the first step of which provides a consistent qualitative input for interpreting economic indicators and setting new focuses, the second step analyses the development of the quantitative economic indicators of companies and the third step analyses the specialisation of the economy. Ideally the data should be obtainable automatically from public resources and databases. One of the aims of this intervention logic in our view should be directing and allocating larger share of available resources (local, regional, national, and international grants, incentives, and other similar measures) to innovative companies.

In order to monitor key areas and growth fields, it is important to combine quantitative and qualitative methodologies, which allow to combine economic indicators of growth fields (historical development) with substantive development dynamics (current challenges) and future visions (joint or agreed estimates of the parties). In order to obtain a qualitative overview, it is worth considering establishing a cooperation platform for each growth field (e.g. on the example of the EU smart specialisation platform, which would require the recruitment of three to four or coordinators, which is a low cost considering the total size of the R&D&I and related smart specialisation activities as the smart specialisation model is expected to remain one of the central principles in the 2020+ period), which would **maintain consistent dialogue and cooperation between local, regional and potentially state representatives and**

companies to achieve common goals. The task of the platform would be to organise regular roundtables, meetings, interviews with growth field companies, R&D institutions, professional associations and other cooperation forms, involving representatives of more active companies and professional associations, as well as representatives of smaller and less influential companies. In addition, researchers from relevant university research groups and representatives of other R&D institutions should be involved in the platform, as joint projects between companies and R&D institutions can be established only through continuous contact. Such a platform would ensure tripartite performance – an input from growth field companies would be provided for planning the strategic activities of smart specialisation (including support measures), information about government activities would reach companies and contacts between scientists, and companies would serve as the basis for developing new project ideas.

This kind of bottom-up approach would serve well interest of policy owner, its subjects (citizens, businesses in region, stakeholders), but also relevant national actors such as ministries and R&D&I institutions by enabling cohesion and coordination between regional and national policies.

4. SWOT analysis of the policy mix

Tartu City, the owner of the selected the policy instrument Development Plan of Tartu 2018 to 2025, has just recently updated it's SWOT analysis regarding the policy instrument and research and development and innovation strategies.

With the aim to gather various perspectives and insights of the strengths, weaknesses, opportunities and threats of the local innovation ecosystem as input for shaping the policies, Tartu City updated the past SWOT based on meetings with different stakeholders and representatives of some of the most relevant players in the local innovation ecosystem. Combining information from the stakeholder meetings with relevant background documents and strategies, the SWOT analysis of the Tartu innovation ecosystem is presented in the following table.

Strengths
• Tartu is the economic leader of South Estonia. • Tartu is a small and compact city where relevant actors and ecosystem members know each other well. • High level of qualification and education – Tartu has 11 higher education institutions and is known for its internationally recognized research.

• Strong start-up ecosystem with many start-up events (e.g. sTARTUp Day, Mobile Monday) and support services (e.g. Tartu Business Advisory Services). • Various incubators and accelerators (Tartu Science Park, Tartu Biotechnology Park, SPARK Hub, Buildit hardware accelerator, ESA BIC Estonia). • Positive competition between business consulting and incubating service providers. • Very good supporting infrastructure in place (core infrastructure, competence/excellence centres), including modern laboratories and technological solutions. • The ADAPTER platform in place – a network of Estonian universities and R&D organizations that provides a quick access to the R&D community for SMEs. • High competence in metalworking, electronics, ICTs, biotechnology, wood processing and food industry in the region.
Weaknesses
• Integrated cooperation, coordination and shared vision between the stakeholders of the ecosystem (especially between universities and technology parks) is limited. • Weak link between science and prototyping, complicated to get to TRL (technology readiness level) 3-7 • There is no available public funding for the “proof of concept” phase in business development. Investors expect a higher TRL. • Lack of companies who would regularly order research from universities or other research infrastructures (e.g. large companies have their own research teams, SMEs have liquidity problems and are not capable of cooperation). • Local innovation ecosystem actors (universities with their various departments, incubators, companies, city) have their own “rules of the game”, no common approach to RII/business cooperation. • Relevant actors work based on projects, which means duplication of similar activities can occur or activities are only carried out/services offered while a project lasts and there is funding for it. • RDI has not made a significant contribution to structural reforms of the economy, RDI is treated as an objective in itself and remains vaguely linked to economic and social goals. • Due to its small size, Estonia is not an attractive market for foreign businesses (start-ups). • Critical mass issues among all sectors and stakeholders (lack of qualified personell, finances, time). • Existing academic career model does not incentivize entrepreneurship.
Opportunities
• Readiness for coordinated activities and planning among local innovation system stakeholders. • Inno Infra Share project contacts provide basis for cross regional cooperation and innovation. • Continuous flow of students who are starting their careers as researchers in Tartu.

• More and more foreign students choose Tartu as a study destination, potential to engage them in the local innovation ecosystem. • Various funding opportunities (e.g. offered by Enterprise Estonia, Estonian Research Council, Interreg) and platforms (e.g. Enterprise Europe Network, Watify) already in place, opportunity to link them with potential beneficiaries. • There have been start-up success stories and good cooperation between different stakeholders that can be brought out as positive examples for emulation.
Threats
• Tallinn can be a more attractive destination for local start-ups (e.g. Tehnopol as a pull factor). • Competition for qualified labor force – researchers and fresh graduates gravitate towards Tallinn and other European capitals. • Potentially too many events aimed at start-ups and businesses in the local ecosystem which can bring about duplication and waste of resources (i.e. the target audience is not able to attend all events offered) • Lack of funding could mean competition for scarce resources rather than cooperation. • Fear of failure, lack of trust, and readiness for cooperation in the business culture. • Incompatible procedures and communication errors between RII and companies • Negative cooperation experiences can reinforce existing stereotypes and hinder further cooperation. • High dependence on (EU) project-based funding among ecosystem stakeholders. • Cooperation between stakeholders id dependent on specific people – if a person leaves, the work starts from scratch. • The outside use of universities' research infrastructure (hardware) can be limited by project and EU funding regulations or by the complexity of the machines (i.e. the entrepreneur cannot work on the machine alone or recalibration of machines takes too long).

5. Main conclusions and areas for improvement

The Development Plan of Tartu 2018 to 2025 outlines the following specific **strategic directions** that are also reflected in this AP. As the policy instrument is a strategy, it does not indicate specific actions in order to reach the goal:

Strategic direction No.	Strategic direction	Related AP action No.	Policy improvement
2.1.1	Supporting innovation, introduction of new technologies and product development.	All	We are making a specific plan for the concept how to initiate university-industry-public sector cooperation on the next level and execute it with this action plan.
2.1.3	Supporting the growth of business productivity.	Action 1a, 1b, 2a, 4a, 4b	The current actions have focused more on general awareness-raising. By doing these new actions, we will have more concrete results. Action 4 will help us to measure and act on the impact of these measures.
2.2.1	Increasing entrepreneurial activity.	Action 2a, 3a, 3b	We are making a specific plan for the concept how to initiate high-school students' and companies' cooperation and how to initiate S2B cooperation on the next level and execute it with this action plan.
2.2.2	Training of skilled labor force.	Action 2a	We are making a specific plan for the concept how to initiate high-school students' and companies' cooperation and how to popularize technical education on the next level and execute it with this action plan.
2.3.1	Improving the quality of support services.	Action 1a, 1b, 2a, 4a, 4b	The current actions and the creation of the support system have been “soft actions”. By doing those actions, we will have more concrete results.

2.4.1	Developing internationalization.	Action 2a, 3a, 3b	We are making a specific plan for study visits, export-related seminars and face-to-face meetings and execute it with this action plan.
2.5.1	Building the image of Tartu as a city with entrepreneurial and high-tech economy and with attractive investment opportunities.	Action 2a, 3a, 3b	Bringing talented people to Tartu for startup events and to show them the environment and business support organisations we have, will help us to become more attractive to nomads.
2.6.1	Creating and implementing a destination brand.	Action 3a, 3b	

Strategic direction No.	**Strategic direction**	**Related AP action No.**	**Related AP action**
3.1	The implementation of the concept of an enterprising university in cooperation between the academic community and businesses.	Action 2a	Organizing seminars to raise awareness of the available cooperation opportunities and platforms.
3.2	The creation of the support system for those leading researchers who deal with fundamental and applied research having an industrial potential	Action 4a	Conducting a feasibility study on how to set up a support fund/measure for financing start-ups and university spin-off companies for their scale-up or development activities (TRL 4-7).
3.4	The development of entrepreneurship support structures within higher education institutions through training and advisory services	Action 1a, 1b, 1c	Organizing trainings to encourage entrepreneurship in education and research institutions.
6.1	Connecting key business sectors in the region with competence centers and support structure networks (RII network). Developing electronics, metalworking, wood processing, food industry,	Action 3a	Promoting cross-regional innovation through different workshops and roundtables which bring together various local and international stakeholders (local

	biotechnology, ICT, health and creative industry sectors.		governments, RII, businesses, start-up scene) from different sectors.
6.2	Supporting businesses in internationalization and export	Action 3b	Organizing study visits and financing stakeholders' study visit initiatives to support internationalization.
6.3	Attracting capital for new technological solutions, product development and the commercialization of research results	Action 4a	Conducting a feasibility study on how to set up a fund/measure to support the own contribution part in different national schemes for early-stage development activities.
7.5	Promotion of cooperation between enterprises, research and development institutions and local municipalities	Action 2b, 2c	Promoting the use of the existing platforms to support matchmaking and information sharing among research institutions and businesses. Promoting participation in different international programs, cross-border initiatives and funding opportunities.

Whilst policy instrument is comprehensive document with many areas and activities which are interconnected and furthermore since it is a living document selecting challenges or goals as "prioritized" compared to others is complicated.

However, some suggestions and focus areas for improvement can be singled out as there are notable developments in these fields or dedicated effort to improve performance there.

1. Focus on Smart City

Connection with policy instrument: how to design/adapt policy instrument to include rapid technological advancements while considering and meeting related cultural, legal, societal, and environmental challenges.

2. Focus on deep-tech and smart economy
   Connection with policy instrument: how to adapt policy instrument to align and involve interests of several different stakeholders who operate with different pace and methods. Notably academia and industry. How can policy instrument encourage and empower emergence of new high value-added jobs and enterprises while respecting autonomy and decision-making of HEI's and private companies.

3. Improved monitoring system of policy instrument
   Connection with policy instrument: Background here being that in digital, data-based information age there is an opportunity to gather huge amount of data. How to do it resource-efficiently, in automated or semi-automated manner, in timely fashion and translate that data into meaningful decision-making tool? Currently policy owner has limited human and financial resource to collect, analyse, interpret, and combine quantitative and qualitative data. Few structural units within city government have started pilot projects of improved monitoring mechanisms. Fully integrated, cohesive, working, cost-efficient system is still a work in process.

4. Better coordination and synergy between actors
   Connection with policy instrument: While in some areas community and different stakeholders are working together well and in coordinated manner, there are areas where there is room for improvement. There are gaps and occasional conflict situations between academia and industry, "traditional" industry and start-up ecosystem, "traditional" industry and environmentally conscious citizens. City government is often looked at to act as intermediator in such situations. Policy instrument could provide guiding direction and act as commonly accepted vision of future.

From recent meetings between policy owner and stakeholders in context of IMPROVE project, two topics have been highlighted which slightly overlap with points above but are noteworthy to express here.

Lessons relevant for Tartu region from other project partners would be:

- Know-how of how other regions monitor and improve their existing policy measures
- Understanding that a common problem among the project partners is related with competence – there is a low availability of quality human resources. Therefore, the effective management and coordination of available infrastructures and human resources is crucial.

Key challenges for Tartu region to address are:

- Brain drain – young talents and specialists leave Tartu for larger centres;
- Modest development aspirations and ambitions of local SMEs;
- Unused potential in cooperation between companies, R&D institutions and business support structures;
- Unstable public financing and decreasing EU funds in the future;