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TARTU BIOTECHNOLOGY PARK
integrated expertise

IMPLEMENTATION PLAN OF TECHNOLOGY TRANSFER IN BIOTECHNOLOGY

Tartu Biotechnology Park AS

2014

Contents

Summary	4
1. Biotechnology sector in Estonia and in Tartu	6
1.1 Definition of biotechnology	6
1.2 Overview of biotechnology sector in Estonia	8
1.3 Biotechnology sector in Tartu	12
2 Technology transfer sector in Estonia and in Tartu	14
2.1 Definition of technology transfer	14
2.2 Innovation support structures in Tartu	16
2.3 Detailed description of the planned activities	22
3 Implementation plan.....	29
3.1 Aims of implementation.....	29
3.2 Implementation plan by activities	30
3.3 Main policy and action recommendations for technology transfer	34
3.4 Barriers and opportunities for technology transfer	36
4 Communication plan	38
4.1 Communication objectives.....	38
4.2 Communication strategy	39
4.3 Communication plan	39
4.4 Detailed overview of communication activities.....	46
4.5 Overview of follow-up communication activities.....	49
5 Budget and financial possibilities for technology transfer.....	50
5.1 Budgets of activities.....	50
5.2 Funding opportunities	55
5.3 Overview of socio-economic impact.....	58
Appendix 1: Glossary of terms used with technology transfer.....	59
Appendix 2. International technology transfer networks.....	64
Appendix 3. Investor networks	69

Appendix 4. Tools for licensing intellectual property.....	72
Appendix 5. Supported technology transfer projects in biotechnology (2008 – 2014).....	73
Appendix 6. Time schedule for planned activities (2014-2016)	74
Appendix 7. Budget for years 2014 – 2016	76

Summary

According to Invest in EU the biotech industry in Europe spends nearly \$7.32 billion in R&D and \$23.2 billion in revenue. Around 20% of the total marketed medicines, and as much as 50% of all drugs that are in the pipeline, are all healthcare biotech products. The European biotech industry provides employment to approximately 95,000 people.

Tartu region is the main science centre of Estonia with strong basic and applied research. The cornerstone of that is the University of Tartu. It is the largest and only classical university in Estonia. Among other fields the university is known for world-class science in molecular biology, genetics, material science, biochemistry, etc. In addition to the University of Tartu, the life science competences are also developed by Estonian University of Life Sciences and Estonian Biocentre and some other institutions. The research potential and qualified specialists are the main competitive advantages of the region.

The main weaknesses concern lack of venture capital in the region, little cooperation between companies, R&D institutions and business support structures, deficiencies in marketing and in efficiency of technology transfer, the low level of research and development investments of the private sector, too few patent applications, a small number of graduates in natural sciences and technology and a modest amount of high-tech exported.

This implementation plan presents some recommendations for Tartu region which are mainly derived from the discussions with different stakeholders paired with the information about existing European good practices of the partner regions involved in the European Union project “Effective Technology Transfer in Biotechnology – ETTBio”.

The aim of the plan is to convince national and local authorities to contribute in:

- strengthening the cooperation between companies, R&D institutions and business support structures involved in biotechnology to use more effectively available resources;
- improving the incubation services to foster and accelerate commercialisation of new knowledge originating from R&D institutions, companies and citizens;
- supporting the availability and utilisation of the pre-seed and seed funding (public and private resources);
- raising awareness of technology transfer and incubation services to introduce available opportunities and support schemes.

The cooperation platform will strive for extensive involvement of regional biotechnology and technology transfer experts in the project activities. In addition to providing biotechnology entrepreneurs with high-quality data, information and know-how to plan e.g. investments and launching technology, various trainings and events will be organized that support the maximization of the public benefit from the activities planned in the project framework. The project also supports communication and networking among the sectoral companies and enhances the visibility of

Estonian biotechnology and technology transfer sector in the market via various promotional campaigns and events.

The main long-term socio-economic impacts of the project are:

- increased levels of employment (directly and indirectly);
- growing annual revenues (tax revenues will grow also);
- bringing new products to the market;
- improved overall health of the population;
- improved environmental status of the region, forming of new enterprises;
- strengthened cross-border cooperation between regions.

The study was compiled in accordance with the requirements of the procurement. The study has been commissioned by Tartu City Government and prepared by Pii Vettik-Leemet, Andrus Tasa and Katriin Antonov, consultants of Tartu Biotechnology Park and Eskil Söderlind, a consultant from Avena Partners.

1. Biotechnology sector in Estonia and in Tartu

1.1 Definition of biotechnology

According to Estonian Biotechnology Strategy 2008-2013, biotechnology can be defined as application of natural science and technology on living organisms or on parts, products and models of these, so that living and non-living material is transformed to produce knowledge, goods or services. Consequently, biotechnology is a term for a collection of technologies based on applying biological processes to solve problems and make products.

The application possibilities of biotechnology are not limited to a single area, but are in fact extremely varied. Biotechnologists conduct research into large and small organisms, plants, animals and humans, but also into the very smallest components, such as individual cells or molecules. As a branch of science, biotechnology is also not as young as some might think. For millennia, people have made use of living microorganisms in their daily lives, for example in the production of beer, wine and bread. Modern biotechnology - as it is applied today - is characterised most of all by the targeted utilisation of the methods of molecular biology. The fundamentals for this area of science were first laid down in the 18th and 19th centuries as the knowledge surrounding microbiology began to grow. For example, with the discovery of the first enzymes as biocatalysts, or of bacteria as producers of substances.

Biotechnology activities also include the support services that do not directly make use of biotechnology activities but provide essential support to those groups that do, e.g. legal services, business and financial support, equipment and reagent supplies etc. This group also includes organizations that form an essential part of the product/process development value chain in biotechnology, for example, clinical trial organizations, organizations conducting field trials for genetically modified organisms (GMOs), groups offering molecular modelling, combinatorial chemistry and molecular synthesis for drug discovery, organizations that assist with process and plant design and engineering etc. To distinguish these different application areas, a colour code has emerged. Thereby, a distinction is made between red, green and white biotechnology, which refers to the areas of medicine (red), agriculture (green) and industry (white). However classifications using many more colours, nearly all tones of rainbow, also exist.

Red will represent health medical and diagnostic aspects of biotechnology. Red biotechnology includes producing vaccines and antibiotics, developing new drugs, molecular diagnostics techniques, regenerative therapies and the development of genetic engineering to cure diseases through genetic manipulation. For example tomatoes protecting against cancers by producing increased level of anthocyanins or transgenic animals-derived drugs against life-threatening diseases.

White biotechnology comprises all the biotechnology uses related to industrial processes - that is why it is also called 'industrial biotechnology'. White biotechnology relays on application of

biocatalysts in industrial processes. Such processes develop dynamically and concur with classical technologies. For example use of microorganisms in chemicals production or the design and production of new materials for daily use.

Green biotechnology represents research related to agriculture processes. It involves the use of environmentally-friendly solutions as an alternative to traditional agriculture and animal breeding processes. Green biotechnology is commonly considered as the next phase of green revolution and brings hope to the fight against hunger on Earth.

In addition, a further distinction is made between these colours with many different shades: grey, purple, yellow, blue, black, brown, gold etc. Grey biotechnology includes all those applications of biotechnology directly related to the environment. Blue biotechnology represents research related to marine and aquatic processes. Black biotechnology involves research related to bioterrorism. Yellow biotechnology is for production of human and animal food. Purple represents the aspects of patents, intellectual property and publications involved in biotechnology. Gold will indicate bioinformatics and nanobiotechnology and brown will signify arid zone and desert biotech.

Nowadays the main competences of Estonian biotechnology lie in medical biotechnology, supported by the heritage of the Soviet period as well, when leading groups in the USSR in exact sciences carried out research at the University of Tartu. Key areas in biotechnology research in Estonia are:

- **Biomarkers.** In medicine, a biomarker is a traceable substance that is introduced into an organism as a means to examine organ function or other aspects of health. Biochemical biomarkers are often used in clinical trials, where they are derived from bodily fluids that are easily available to the early phase researchers. In cell biology, a biomarker is a molecule that allows the detection and isolation of a particular cell type.
- **Genomics** is a discipline in genetics that applies recombinant DNA, DNA sequencing methods, and bioinformatics to sequence, assemble, and analyze the function and structure of genomes. The field includes efforts to determine the entire DNA sequence of organisms and fine-scale genetic mapping. For example next-generation genomic technologies allow clinicians and biomedical researchers to drastically increase the amount of genomic data in disease research, allowing researchers to better understand the genetic bases of drug response and disease.
- **Personalized medicine** is an emerging practice of medicine that uses an individual's genetic profile to guide decisions made in regard to the prevention, diagnosis, and treatment of disease. Knowledge of a patient's genetic profile can help doctors select the proper medication or therapy and administer it using the proper dose or regimen.
- **Stem cells.** A stem cell is a cell with the potential to form many of the different cell types found in the body. When stem cells divide, they can form more stem cells or other cells that perform specialized functions. Embryonic stem cells have the potential to form a complete

individual, whereas adult stem cells can only form certain types of specialized cells. Stem cells continue to divide as long as the individual remains alive.

- **Nanoparticles.** A nanoparticle is a microscopic particle with at least dimension less than 100 nm. Nanoparticle research is currently an area of intense scientific research, due to a wide variety of potential applications in biomedical, optical, and electronic fields. Nanoparticles often possess unexpected optical properties as they are small enough to confine their electrons and produce quantum effects.
- **Point-of-care diagnostics** are medical tools or devices that can diagnose disease in a patient's community, generally outside of a formal clinic setting. By shifting disease diagnosis to the community level, point-of-care diagnostics can save patients money (as they no longer have to travel to clinics), allow earlier diagnosis and expand access to previously under-served populations.

1.2 Overview of biotechnology sector in Estonia

Estonia's economic growth in 2013 slowed as the growth of the expected recovery in the 2014. Although the growth rate has steadily slowed over the past three years, it has not impacted household economic situation and the state budget negatively. The labour market has continued strong increase in wages; household incomes and consumption have increased over the last year.

Economic sentiment in the EU has been continually and rapidly improving. Clear improvement has taken place in industry, services and for consumers. Since the recovery in most Estonian export partners has been quite good already during the previous year, not much additional impact on Estonian export demand is expected from the improvements in recent EU averages. More broad recovery should still indirectly support the external environment of our partners.

The entrepreneurship indicators of Estonia place us into the same category with developed countries, above all, Scandinavia. However, compared to them, one of the main problems that we experience is low added value per employee – in 2012, the respective indicator for Estonia was approximately 70% of the European Union average. For development of Estonia's economy, education must match better with the requirements of business, export and knowledge-based entrepreneurship must be increased, internationalisation must be enhanced and also innovative start-up enterprises need to be favoured by government level.

Estonia is moving, step by step, towards a more complicated economy that creates higher added value and this can also be observed in the employment market – the importance of specialists and skilled workers is increasing while the demand for unqualified labour is falling.

Estonia has been one of the most active countries in Eastern Europe with regard to creating companies. In 2011 a total of 7.4% of employed people in the age group of 15–64 are entrepreneurs

in Estonia. The total entrepreneurial activity of Estonia, counting both early stage and established entrepreneurs, is 20.7%, which is a medium value among the countries comparable to us.

Estonia has undergone remarkable development from a closed country occupied by the Soviet Union to an active partner in the global economy, prone to adopting new technologies. The liberal economic environment, favourable towards entrepreneurship, has fuelled the growth of the Estonian economy. Biotechnology-related legislation in Estonia is well-established and harmonised with EU legislation. The importance of progress in this sector is also recognised by the government as one of the strategic key technologies. However, today Estonian R&D costs constitute little less than 1% of GDP. The specific goal is to increase R&D costs to 1% of the GDP by 2015. Millions of Euros have been invested in up-to-date laboratory infrastructure enriching the equipment pool of the Estonian Biocentre and University of Tartu, e.g. core laboratory of sequencing and genotyping (incl. Illumina Beadstation 500GX genotyping platform), core laboratory of biomedicine and molecular and cell biology, transgenic technology core laboratory, core laboratory of applied virology and the core laboratory of proteomics. Biotechnology is also continually under special attention of Estonian State: in February 2007 the Estonian parliament approved Estonian Research and Development and Innovation Strategy 2007-2013 “Knowledge-Based Estonia”, where biotechnologies are defined as one of strategic key technologies in supporting R&D and innovation.

Majority of Estonia’s main biotechnological research institutions and companies are active in the field of red biotechnology associated with biomedicine and human health focussing on support services for drug development, diagnostics etc. Less are active in the fields of industrial „white biotechnology”, including biochemistry and organic synthesis, environmental studies and mediation of laboratory equipment and reagents.

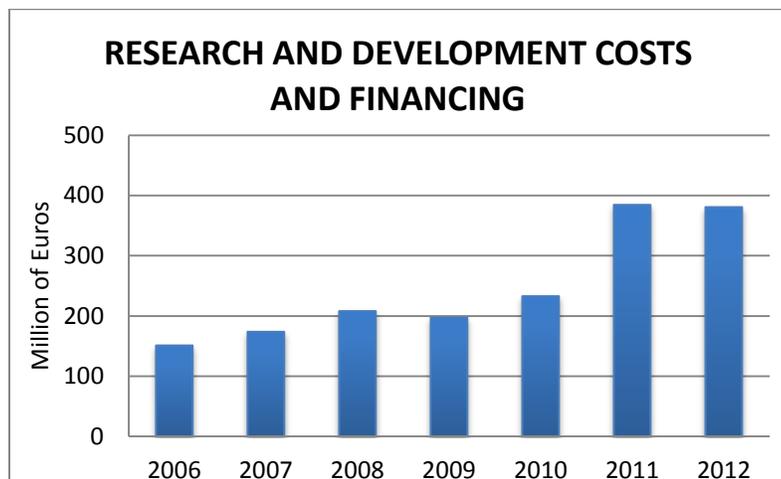
The main competences of Estonian biotechnology lie in medical biotechnology - immunology, genomics and cancer research. Industrial biotechnology is also rather advanced developed both on the research and industry side, including biochemistry, organic synthesis, environmental and food biotechnology.

There are many advantages of the biotechnology sector in Estonia: the state supports R&D and innovation; the economic environment in Estonia is generally liberal and favourable towards entrepreneurship; biotechnology-related legislation is well-established and harmonized with EU legislation. The sector offers a good scientific foundation and a large network of contacts, mainly with the Scandinavian region. The benefits also come from good quality labour force - over the past few years there has been a trend of scientists repatriating; and approximately 500 graduates with relevant education enter the labour market every year.

According to Estonian Research and Development and Innovation Strategy report in 2012 R&D intensity continued to increase also in 2011 reaching an extraordinary level: R&D investments grew from 1.63% to 2.41% of GDP. Such an increase occurred due to double growth of the private sector investments and the 22% growth of public sector investments. According to Statistics Estonia, the

financing of R&D expenses from the state and local budget formed 0.79% of the GDP in 2011. As stated by Estonian Research and Development and Innovation Strategy for 2014-2020 R&D investments will be raised by 2015 to 1% of GDP and thereafter it will be maintained at that level.

Figure 1. Research and development costs and financing 2006 – 2012

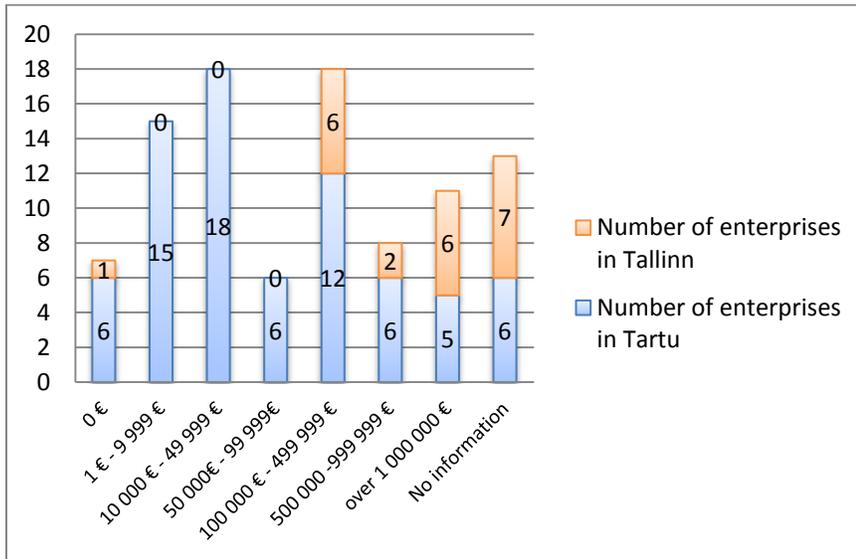


Source: Statistics Estonia 2014

With regard to financing sources of R&D in 2011, financing has increased from all sources, while growth in enterprise sector and foreign sources has more than doubled. The public as well as the private sector receive financing from three sources. The most important source in both cases is self-financing: public sector receives mainly government funding, enterprise sector private funding (Estonian Research and Development and Innovation Strategy 2007-2013 “Knowledge-based Estonia” Report on achieving the objectives and implementing the strategy in 2012).

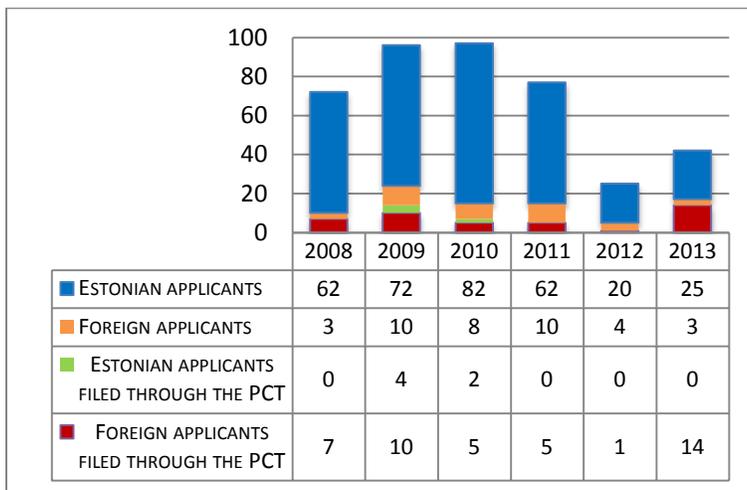
In 2014, there are about 97 Estonian companies, employing over 600 specialists, working in the field of biotechnology. Most of the companies are located in Tartu (about 72) or in Tallinn (23). 5 of them are competence centres: Bio-Competence Centre of Healthy Dairy Products, Competence Centre on Reproductive Medicine and Biology, Competence Centre for Cancer Research, Estonian Nanotechnology Competence Centre and Competence Centre of Food and Fermentation Technologies. Most of the businesses are small with less than 10 employees. Turnover in year 2012 was approximately 4,84 MEUR.

Figure 2. Turnover of biotechnology companies (2012)



Estonian companies have about 40 patents and patent applications in their patent portfolios. Of the companies founded prior to 2005, 50% have a patent portfolio, while for the companies established in the last two years; this indicator is at 90% (Estonian Biotechnology Strategy 2008-2013).

Figure 3. The number of applications per year, 2008 - 2013



However, the capacity of the R&D companies for commercialization of new technologies is weak and the competence in international marketing and sales and technology management is limited.

1.3 Biotechnology sector in Tartu

Tartu is the second largest city in Estonia often considered to be the country's cultural and intellectual capital. Tartu was first mentioned in written in 1030, hence the city boasts a history of about 1000 years. The city is the centre of southern Estonia and it has around 100,000 inhabitants. Tallinn, the capital of Estonia is situated 190 km northwest of Tartu.

Tartu is a student city mainly because of housing the University of Tartu which is among the oldest universities in northern Europe. It was established in 1632 and it is the only classical university in Estonia. Tartu is also the hometown for the Estonian University of Life Sciences, the Baltic Defence College, Tartu Health Care College and several other education institutions. With so many higher education institutions in the city, Tartu inevitably attracts a lot of talented and innovative people from other parts of Estonia and abroad.

Besides being the hub of research and education Tartu is also an important commercial and business centre and an increasingly popular tourist destination. Although recent economic recession has had an impact in Tartu (for example increase of unemployment), the growth has been stable and the population has not decreased, thanks to its central role in the region.

Tartu is the centre of Estonia's medical and biotechnological landscape. The University of Tartu Hospital – a unique medical care and training hospital in Estonia – and world-class research & development centres in the field of medicine and biotechnology gathered around the University of Tartu, strong private medical practices as well as biotechnology companies lay the basis for promising future developments.

The University of Tartu includes several important institutions that play a central role in the development of life sciences in the region. The **Institute of Molecular and Cell Biology** is a leading science centre for research and teaching in rapidly developing fields: fundamental and applied studies in molecular biology, cancer research, human genetics, and studies of complex genetic diseases. **Estonian Genome Centre** was founded by the Government of Estonia in 2001 and was subsequently reorganized as a research institution affiliated with the University of Tartu. The aim of the centre is to create a database of health, genealogical and genome data of Estonia's population. By now the centre has created a gene bank with access to more than 60,000 samples. The **Institute of Technology** is a research and development institution working in close co-operation with other R&D centres and support units that play key roles in commercialising the intellectual property generated in the University of Tartu. Significant competence and infrastructure is also gathered in the **Faculty of Medicine**.

Besides the University of Tartu, the life science competences are also developed by **Estonian University of Life Sciences** and **Tartu Health Care College**. In addition, **Estonian Biocentre** is situated in Tartu and the main research direction of it is in the field of molecular medicine.

One of the great assets of Tartu is **Tartu University Hospital** which is the only teaching hospital in Estonia and therefore working in a close cooperation with the Faculty of Medicine of the University of Tartu. The hospital is the largest provider of medical care in Estonia and it has more than 3,800 employees.

The region has also several support structures that enhance entrepreneurship in the field of life sciences and promote establishment of new companies. **Tartu Science Park** is the oldest science park in the Baltic States (founded in 1992) and it supports business innovation activities in the region through networking with universities, public and private sector. **Tartu Biotechnology Park** provides physical infrastructure as well as business development and consultancy services especially to companies and R&D institutions in the fields of biotechnology, medicine and veterinary medicine. The incubation services of Tartu Biotechnology Park are complemented by the Nanolab (clean room facilities for nanotech R&D) and the start-up accelerator BuildIt situated in Tartu Science Park.

Although the biotechnology is not yet among the most important economic sectors in Tartu regarding turnover or employment opportunities, the potential of it in Tartu has already initiated the creation of several **high-tech companies**. These include mainly biotechnology companies (Icosagen Group, Asper Biotech Ltd, Solis BioDyne Ltd, TBD Biodiscovery, etc.) and also some private hospitals and clinics (Clinic Elite, Medex Ltd, etc.). In addition, the companies and R&D institutions of Tartu participate actively in Estonian competence centres (Bio-Competence Centre of Healthy Dairy Products, Centre on Reproductive Medicine and Biology, Competence Centre for Cancer Research, etc.) and clusters (e.g. Estonian Cell Therapy Cluster). Majority of Estonian biotechnology companies are active in red biotechnology.

Due to the small size of the internal market, products and services are mostly exported. The main export markets are Finland, Sweden, Germany and United States, but the importance of France and Great Britain is growing as well. International networking is enhanced through participation in the research and development projects supported by the European Commission.

2 Technology transfer sector in Estonia and in Tartu

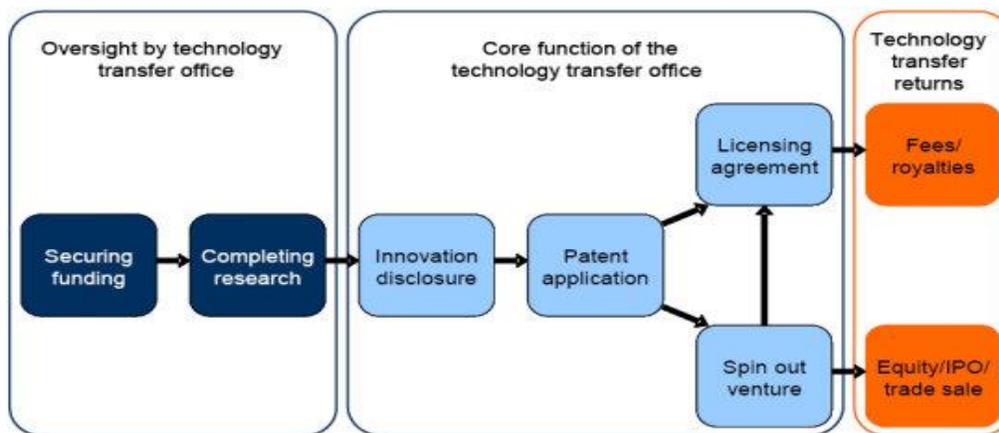
2.1 Definition of technology transfer

Technology transfer (TT) can be broadly defined as the process of converting scientific findings from research organisations into useful products for the commercial sector. TT is also known as „knowledge transfer or knowledge sharing“. This is the process whereby an enterprise converts scientific findings from research laboratories and universities into products and services in the marketplace. TT can take three channels:

- the creation of new companies (spin-outs), which often involves some transfer of personnel (mobility of researchers);
- collaboration between universities, research organisations and industry notably via research contracts; and/or
- licensing of IP.

TT often involves a formal transfer of rights to use and commercialize new discoveries and innovations from scientific research to another party. The TT process also covers funded research, innovation disclosure, patents, and licensing and sometimes new start-up ventures. Returns on TT are primarily in the form of licensing royalties, but also include sponsored research, one-off transactional fees and new venture equity. Figure 4 summarizes the TT process from the securing of funding to the generation of TT returns, considering the core functions of a Technology Transfer Office (TTO).

Figure 4. Technology transfer process



There are different ways for implementing technology transfer process:

Flow-system model can serve as a strategic planning tool for scientists, business leaders, marketing people and other key decision-makers allowing them to make constructive interventions to facilitate progress in transferring technology to a tangible end use. Technology transfer process has 6 phases: technology innovation, technology confirmation, targeting technology consumers, technology

marketing, technology application, and technology evaluation. Scientists can influence this road, once they obtain a basic understanding of the technology transfer process.

Partners Program – between universities and companies/organisations. Partners Program can provide a comprehensive technology transfer effort to focus on increasing the coordination, communication and collaboration among public agencies, universities, and industries. Partners Program includes six activities:

- 1) The first activity focuses on marketing the new Partners Program (logo, brochure, webpage, articles, presentations in conferences, etc);
- 2) Second step is to implement an Interactive Webpage that will become meeting/information exchange point for universities, companies and public sector. For example, the company can provide information on critical research needs that university partners can pursue. Universities can post information on licensing opportunities for industries. Industries can post information on their products for public agencies. Public agencies can post needs for products and share experiences with other agencies.
- 3) Further interaction among partners should take place in appropriate meetings and conferences. It is important to link groups with similar interest and help link research with licensing and product development opportunities.
- 4) A wide range of techniques, including online courses, web seminars, workshops, and conferences could be used to provide training on different topics (intellectual property, invention disclosure, licensing, and commercialization).
- 5) Partnership Networks and User Groups could be established around specific topics and issues. These networks and groups could provide support to different subgroups or be organized around different topics of interest.
- 6) Recognizing successful activities and efforts is a key element to maintain support and ongoing participation, the program could recognize best practices, innovative partnerships and advances in deployment with partners' program awards.

Expand Small Business Mentoring and Support Program. Often, small businesses and entrepreneurs select not to pursue the transfer of technology from the government because of the following reasons:

- 1) lack of resources to spend the time understanding the available technology;
- 2) not enough time or resources to invest in understanding the processes and regulations for licensing the technology; or
- 3) lack of awareness of the available technologies, research facilities and programs offered to small businesses.

Networking activities – the program could hold networking activities like showcase forum events for entrepreneurs to become aware of related technologies and how to gain access to the new technology. Small Business Partnering activities – program could offer opportunities for small

businesses to partner with large firms. The micro-grant funding support provided by program could support small businesses with the transfer of their technology.

2.2 Innovation support structures in Tartu

Innovation support structures are institutions, which main aim is to support the implementation of outcomes of research and development on commercial purposes. Innovation support structures include science and technology parks, technology and innovation and incubation centres, technology transfer divisions of universities and professional higher education institutions, etc. This subchapter will give an overview about connected innovation support structures in Tartu region.

Government facilities

The City Council of Tartu

Estonia offers foreign companies an ideal entrance to the large and fast-growing markets of the Baltic Sea Region. Open economy, excellent transportation links and central location make it an ideal base for production and distribution with all the region's main markets within easy reach. Tartu has all the best of the globally new but with the local advantage – the costs are lower, security is higher and air is cleaner than in Tallinn, Helsinki or New York. Tartu is a university town and known as a centre of education in Estonia. Tartu is also an internationally known research town. The majority of Estonian life sciences and medicine R&D activities are concentrated in Tartu. Also, more than 60% of the total Estonian research potential is concentrated in Tartu.

The City Council of Tartu with its 49 members is the representative body of the municipal government that is elected by the electorate of the city of Tartu in every four years. The exclusive competence of the City Council includes many important decisions such as adoption and amendment of the city budget and assumptions of loans, adoption of the city development, comprehensive and detailed plans, etc.

Department of Business Development of Tartu City shares information about the business administration, support and development opportunities and the business environment 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. Key sectors in Tartu are: metal processing and machine building, IT, wood and biotechnology sector and food industry.

Tartu City Government is selling properties in Tartu for Industrial Parks, which have good geographical location and well-developed infrastructure. Industrial Park land lots can be used for industrial and commercial purposes. The sizes of the land lots range from 1,625 to 35,000 square metres.

Technical Transfer Offices (TTOs)

Estonian Chamber of Commerce and Industry

Estonian Chamber of Commerce and Industry assists foreign companies in establishing contacts with Estonian entrepreneurs as well as in introducing Estonian economy and investment environment.

- Organising a presentation and programme in Estonia. Estonian Chamber of Commerce and Industry assists foreign companies to establish contacts with Estonian entrepreneurs, introduce them Estonian economy and investment environment. Estonian Chamber of Commerce and Industry receive business delegations and, if necessary prepare the required programme.
- Conducting search from the exporters database Estonian Export Directory (<http://www.estonianexport.ee/index.php?lang=eng&name=&industry=&product=&ttype=0&detail=0&page>)
- Searching for co-operation partners. Estonian Chamber of Commerce and Industry perform searches among the members of the Chamber of Commerce according to your wishes and profile. An employee of the Chamber of Commerce will establish which companies comply with your profile and are interested in cooperating with you, and will provide with potential partners' contacts.
- Conducting researches from [Enterprise Europe Network](http://enterprise-europe.ee) (<http://enterprise-europe.ee>) The Enterprise Europe Network is a key instrument in the EU's strategy to boost growth and jobs. Bringing together close to 600 business support organisations from more than 50 countries, we help small companies seize the unparalleled business opportunities in the EU Single Market.

The Estonian Intellectual Property and Technology Transfer Centre (EIPTTC) is foundation founded by Estonian Chamber of Commerce and Ministry of Economic Affairs and Communication. EIPTTC predecessor was Estonian Patent Information Centre. EIPTTC offers wide variety of intellectual property and technology transfer support services, training and education.

EIPTTC and online search possibilities guarantee the possibility of carrying out examination to novelty and state of art of the applications for registering the subjects of legal protection of industrial property by the Estonian Patent Office as well as for research purposes.

Universities

University of Tartu (UT) was founded in 1632 and it is considered the only classical university in Estonia. Tartu Universities unique strength is its expertise that involves all major categories of research - realia et naturalia, medicina, humaniora and socialia, making UT the leading centre of research and training in Estonia. The university consists of nine faculties, four colleges and several other sub-institutions. Biotechnology plays a significant role in UT's work – the university includes a Faculty of Medicine, a Faculty of Science and Technology, the Estonian Genome Centre, which serves as the Estonian biobank, and the Office of Research and Development. The total R&D expenditure of University of Tartu in biological sciences amounted to 70,000,000 Euros in 2005-2010. University of Tartu has 3,160 faculty members and 1,740 research employees. There are over 17,000 students in the university, of whom 1,500 are doing their PhD.

University of Tartu contributes to innovation in Estonian economy and beyond, bringing university research results to real applications. This is the third major pillar besides education and broadening the frontiers of knowledge - applying the knowledge to society. The mission statement of the university is to be the leading force in the development of knowledge-based society, and to guarantee sustainability. Knowledge implementation to economy can be divided into two categories:

- technology transfer: where existing know-how is implemented;
- development cooperation: where scientist develop a specific solution for company's problem.

In reality these two exist together more or less: in technology transfer there is development cooperation and vice versa, but it all depends on particular needs and circumstances.

Estonian University of Life Sciences is the only university in Estonia whose priorities in academic and research activities provide the sustainable development of natural resources necessary for the existence of man as well as the preservation of heritage and habitat.

The academic structure is composed of research and development institutes or institutions, centres and other structural units. Currently, teaching and research is carried out in five institutes:

- Institute of Veterinary Medicine and Animal Sciences
- Institute of Technology
- Institute of Agricultural and Environmental Sciences
- Institute of Forestry and Rural Engineering
- Institute of Economics and Social Sciences

The Estonian University of Life Sciences participates in the **SPINNO programme**. The general objective of the programme is the increase in the sustainability of the function of transfer of

knowledge and technology as the strategic mission of the Estonian research and development establishments and institutions of applied higher education on the equal bases with the studying, research and development work.

Incubation centres

Tartu Biotechnology Park (TBP) provides physical infrastructure as well as business development and consultancy services to companies and R&D institutions in the fields of biotechnology, medicine and veterinary medicine. It supports companies in finding cooperation partners and is active in the establishment process of new companies.

The activity of TBP stands on five pillars - quality, cooperation, competence, information and innovation. The aim of TBP is to create a favourable and developing environment for the promotion of biotechnological entrepreneurship in Estonia. In order to achieve its aims and to provide better services TBP engages in active cooperation with Estonian and foreign biotechnology companies, research and development institutions, foundations for the development of entrepreneurship and biotechnology and other organizations, including state agencies and local authorities. TBP also participates actively in the programs and projects financed by the European Union and Estonian government.

From September 2005 TBP runs the BioMed Incubator for biotechnology, medical and veterinary businesses. BioMed Incubator started with 5 enterprises in the incubator. At the moment there are 19 enterprises in the incubator (1 veterinary medicine, 7 medicine and 11 biotechnology enterprises).

Through offering high quality infrastructure services as well as business development and consultancy services, it aims to create a favourable environment for start-up enterprises boosting their growth and competitiveness. TBP's advisory services are focused on innovative and technology based enterprises.

Since 2005 TBP is a member and local contact point of ScanBalt - an organization that incorporates countries along the Baltic Sea. As a network of networks it aims to promote the development of ScanBalt BioRegion as a globally competitive meta-bioregion.

Tartu Science Park is the innovation engine of South Estonia. Their mission is to nurture start-up companies into global businesses. Tartu Science Park is the first science park in the Baltic's, founded in 1992 by Tartu city, county and two universities. For more than 20 years, they have supported business innovation activities in the region by networking with universities, public and private sector.

To foreign companies, Tartu Science Park offers their help in extending business to Estonia where the economic environment is characterized by qualified workforce, favorable tax system and liberal markets.

Tartu Science Park is a participant in the Enterprise Europe Network (EEN).

EEN has more than 580 member organizations across Europe and beyond. The project has a daily updated technology database. An entrepreneur using our services can submit to the database their technology offer/request and gather information about international partnership offers.

The database provides companies and universities an opportunity to:

- find international co-operation partners for developing, improving and marketing a novel product or technology;
- co-operate with the most innovative organisations in Europe in order to solve a technological issue;
- keep themselves updated with the most novel technologies in their field;
- obtain international orders and fruitful co-operation offers for R&D.

In order to promote technology transfer, the EEN is also organising a number of brokerage events all over Europe.

TSP started new technology accelerator named BuildIt. BuildIt is the accelerator in the Baltic States with focus on physical devices and is accepting hardware start-ups worldwide. Mentoring program lasts for 3 months and during that time it is possible to use prototyping facilities and get free or discounted services from partners – that includes development tools, design services, legal and accounting services, etc. Investment to projects is up to €20,000 in exchange up to 12% shares of the company. More advanced teams with traction (e.g. first product on the market, working on new version) are preferred to get into the program. Besides help and mentoring, 3 month program also consists of trips to trade shows, meetups and pitching events to investors to build the network, meet manufacturing partners and attract follow-on investments. At the end of the program you'll have a prototype and skill-set necessary to successfully move on to the global start-up and investor hubs.

Idea Lab in Tartu University

Idea Lab is a place where energetic people can work together to find exciting and innovative solutions to their problems. Idea Lab has 3 programs: Tramm 11, Student Company Program and prototype centre. **Tramm 11** will bring the knowledge and skills into practice. This is an 11 week program for student teams to make exciting ideas into real solutions. Program also includes seminars, workshops, meetings with businesses and much more. **Student Company Program** will help students to begin their real business. The program lasts for 11 months and consists personal counselling and support to implement their business idea, trainings to develop knowledge and skills

and assistance for applying to incubators, accelerators and grants. It is a valuable opportunity to develop network of contacts. **Prototype center** enables scientists to create prototypes that help bringing innovative solutions to companies and economy. Prototype centre laboratories can be a real test of your product or service. There are five laboratories: laboratory of electronics, virtual prototyping laboratory, teamwork laboratory, rapid prototyping laboratory and laboratory for analyzing the user's preferences.

Patent bureaus

Innovation and Patent Bureau Ustervall was founded in 1997. Services include protection of industrial property - patents, trademarks, designs - as well as patent and trademark searches and consultancies on intellectual property in technology development and transfer projects.

Patent specialists have been working in the field since 1980 (Patent Department of Tartu University), having Estonian Patent Attorney`s qualification since 1992, simultaneously with the restoring of the industrial property protection in Estonia.

Services:

- protection of industrial property - inventions, trademarks, designs;
- patent searches - state of the art searches, novelty searches;
- trademark searches;
- consultancies on intellectual property in technology development projects;
- technology transfer, licensing, contracts;

Ustervall is European Patent Attorneys since 2002. There are two registered Patent Attorneys: Sirje Kahu and Arno Anijalg and also lawyer`s Anne Kalvi (intellectual property) and Kadri Aua.

The **Patent Agency Sarap & Partners** was founded by Margus Sarap in 2008, after 15 years of work in the sphere of industrial property. The goal of the patent agency is a desire to provide professional counselling in the filing and proceeding of legal protection applications, providing various patent surveys and other services, which help the entrepreneurs to better navigate in the industrial property environment.

Patent Agency Sarap & Partners introduce the interesting and complicated world of intellectual property and industrial property in particular, and provide:

- the legal protection of intellectual property in Estonia and foreign countries, representation clients before European Patent Office, OHIM and Estonian Patent Office;
- consultations regarding intellectual property;
- searches regarding patents, trademarks, designs and prior art;
- IP portfolio management;
- IP audits and strategy planning.

Private companies

Civitta is a leading independent management consultancy in the Central and Eastern Europe with offices in Estonia, Latvia, Lithuania, Belarus and Ukraine. Civitta provides the full span of consulting services from problem or opportunity recognition and action planning to identification of financing solutions and decision implementation support. They help clients to plan activities to reach their goals, execute relevant studies, build staff know-how, find needed financing sources, or lend our human resources to jointly implement projects. Civitta team members have experience as start-up entrepreneurs and investors; they have also been active in developing the support structures of start-ups. They possess experiences and contacts, which help start-ups to develop and grow. They help to decide, which strategy is the best one for a company, which products or services are essential for clients and how to develop these. Civittas team advice to choose the best investment scheme and engage investors or public sector funding.

Baltic Innovation Agency (BIA), a member of Enterprise Europe Network, is providing innovation, clustering, technology and business development related services to public, private and third sector organizations. BIA is working with different cluster development activities and initiatives in various sectors focusing on issues like cluster internationalisation, joint marketing and branding, human capital development and training. BIA is implementing projects both in traditional industries such as wood, forest, food, chemical, energy and environment sectors but also in new sectors like biotechnology, nanotechnology and ICT. The main competence areas where BIA is offering development services and training are the following – cluster management, strategic and business planning; technology transfer and commercialization, market research and analysis, innovation financing and investment readiness; intellectual property rights; evaluation, benchmarking and foresight.

2.3 Detailed description of the planned activities

For implementing planned activities, first, a consortium or focus group of interested parties should be formed. Given description of planned activities divides interested parties into two main groups: consortium and group of representatives.

The consortium involves three partners – Tartu City Government, Tartu Biotechnology Park and Tartu University. Other involved organisations are following:

- Estonian Chamber of Commerce and Industry;
- The Estonian Intellectual Property and Technology Transfer Centre;
- Estonian University of Life Sciences;
- Estonian Genome Centre;

- Tartu Science Park;
- Bio-Competence Centre of Healthy Dairy Products;
- Competence Centre on Reproductive Medicine and Biology;
- Estonian Nanotechnology Competence Centre;
- Tartu Health Care Collage;
- Competence Centre of Food and Fermentation Technologies;
- Innovation and Patent Bureau Ustervall;
- The Patent Agency Sarap & Partners;
- Other relevant organizations and companies.

Also, different technology transfer networks and investor/business angel networks are included into group of representatives. Setting up a group of representatives of the organisations is starting in September 2014 (see appendix 6) and should be functional and started with regular meetings by the end of November 2014.

This group of TTO representatives are dealing with following activities:

- creating information flow: lab visits, innovation meetings, TT guide for inventors;
- creating contact network: forming target groups (businesses) for specific research areas;
- giving follow-up of invention disclosures/patent applications to inventor;
- organising trainings/seminars: entrepreneurial learning, entrepreneurship programs, IP courses;
- encouraging researchers to contact TTO before any publication - provide guidance and support;
- marketing activities: regularly visiting potential customers;
- starting regular cooperation between technology transfer experts and universities;
- promoting research institutions;
- establishing joint postgraduate degrees, postgraduate industrial training and industrial real-life courses;
- bring new teaching principles and industry-based case studies;
- Masters and PhD qualification in industrial research, based on research institutes and leading manufacturing companies;
- cooperation should be shown as being beneficial to both parties: a win - win situation for both parties at all levels and in all activities;
- cooperation is coordinated and implemented by official bodies or structures which report on a regular basis to all the governing structures concerned;
- industry participation in academic planning and course design.

Also, creating common web platform is one of the needs. For example, webpage named Invest in Tartu should be the official regional business promotion agency for Tartu region. It is part of the

marketing organisation called Department of Business Development, which is owned by the Tartu City Government. Main goal is to promote business in Tartu and share information about Tartu region, business environment and key economic sectors.

The project builds on the current strengths of each project partner in order to fulfil the needs of Estonia and Tartu region. The main competences of the project partners are presented in the next table.

Table 1. Main competences of consortium partners

Name of the project partner	Location of activity	Main competences contributing to the project
Tartu City Government Department of Business Development	Tartu	The exclusive competence of the City Council includes many important decisions such as adoption and amendment of the city budget and assumptions of loans, adoption of the city development, comprehensive and detailed plans, etc. Department of Business Development of Tartu City shares information about the business administration, support and development opportunities and the business environment in Tartu and possesses extensive contact list of mentors and potential investors.
Tartu Biotechnology Park (TBP)	Tartu, Estonia	TBP has extensive list of networks in the field of life sciences and is contact point of ScanBalt. TBP runs BioMed Incubator (currently with 19 incubants) and has access to new ideas and start-ups. Also, TBP have previous experiences with technology transfer in the field of biotechnology.
Tartu University (UT) The Office of Research and Development (TTO)	Tartu (collages in Pärnu, Narva, also European Collage in Tartu)	(TTO) serves several functions – the Office consists of Research Administration Unit, Research Project Unit, Intellectual Property Unit, Industrial Liaison Unit, and Career Unit and has access to different researchers and students, also to potential start-ups (through IdeaLab)

To achieve project objectives, following methods have been chosen:

- Investments - development of modern webpage to promote biotechnology knowledge and technology transfer in Tartu region;
- Co-operation initiatives: setting up a group of representatives of the organisations (companies, R&D institutions and business support structures) aimed at developing biotechnology and technology transfer in Tartu; start of regular meetings to share information and launch new initiatives to support technology transfer in biotechnology; stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists and more proactive involvement in international technology transfer networks and projects (actions 1 – 4);
- Research and analyses – formation of coordinated action plan to attract foreign biotech companies to the region of Tartu and a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project) (action 1); formation of study about developing incubation services in the region of Tartu 2015-2020 (action 2);
- Study visits - exchange competences between partners and with other business support structures (actions 2 and 4);
- Trainings - systematic attention on developing regular cooperation between technology transfer experts and universities, including involvement of experts in teaching technology transfer courses in the universities and making these courses more open for companies and inventors (action 1); start a greater and more systematic involvement of foreign experts and investors in developing local companies (trainings, seminars, consultations) and developing a network of mentors (action 2);
- Communication and promotional activities - public information and leaflets about activities and results; national campaigns and fairs for start-ups, researchers and TT experts to network and presentations; regional promotion of short videos about companies, R&D institutions and business support structures and gaining more media attention to the issues of commercialization, technology transfer and start-up companies in the field of biotechnology (actions 2 – 4).

Partners see this approach constituting logical integration: investments as well as upgraded competencies via trainings and study visits and planned promotional activities are needed postulates prerequisites for high-quality to research comparative and analyses aimed at developing and testing the new solutions to the common problems of technology transfer in biotechnology. The results of the project will serve the public and be used by target groups and interested parties.

Tartu City Government

Department of Business Development of Tartu City

Department of Business Development of Tartu City implements the business development plan for Tartu and mediates business contacts and gives counselling to entrepreneurs, provides them with relevant materials. Also organises seminars on entrepreneurship, information days and entrepreneurship competitions and coordinates trading in the fairs organised by the City Government.

Key tasks and activities of Tartu City Government are following:

- 1) **Organising a group of representatives of the organisations for developing biotechnology and technology transfer in Tartu region**, starting regular meetings for sharing information and coordinating joint operations to attract foreign companies to the region of Tartu.
 - a. In collaboration with Tartu Biotechnology Park starting regular meetings to share information (including new ideas and results from the science) and launch new initiatives for supporting technology transfer in biotechnology;
 - b. Development of a modern website about the biotechnology sector in Tartu region (jointly with Tartu Biotechnology Park and Tartu University);
- 2) **Attracting foreign companies and investments to the region of Tartu**
 - a. Start of coordinated joint operations to attract foreign companies to the region of Tartu (jointly with Tartu Biotechnology Park and Tartu Science Park);
 - b. Increase of focus on internationalisation;
 - c. Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors etc. (jointly with Tartu Biotechnology Park and Tartu University);
 - d. Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology;
- 3) **Involvement in different technology transfer and business angel's networks.**
 - a. Support for local companies to participate in internationally recognized venture capital and business angel's events (jointly with Tartu Biotechnology Park and Tartu University);
 - b. Stronger and more proactive involvement in international technology transfer networks and projects (jointly with Tartu Biotechnology Park and Tartu University);
- 4) **Participating in different expert visits, fairs and seminars.** During project period, there are planned several meetings, expert visits, fairs, training, informational days and seminars, what needs to be organized or attended by project team and target groups.

Tartu Biotechnology Park

Tartu Biotechnology Park (TBP) supports companies in finding cooperation partners and is active in the establishment process of new companies. In order to achieve its aims and to provide better services TBP engages in active cooperation with Estonian and foreign biotechnology companies, research and development institutions, foundations for the development of entrepreneurship and biotechnology and other organizations, including state agencies and local authorities. For implementing current activities, TBP will collaborate with Tartu Science Park in the field of technology transfer. Tartu Biotechnology Park has its own incubator in the field of biotechnology and Tartu Science Park runs its technology accelerator BuildIt. Aims of this collaboration are to develop and provide more advanced incubation and acceleration service in the field of biotechnology.

Key tasks and activities of Tartu Biotechnology Park are following:

- 1) **Conducting studies about incubation and technology transfer in the region of Tartu**
 - a. Conducting a study about developing incubation services in the region of Tartu 2015–2020 (jointly with Tartu Science Park);
 - b. Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu (jointly with Department of Business Development of Tartu City and Tartu University);
 - c. Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project) (jointly with Department of Business Development of Tartu City and Tartu University).
- 2) **Developing incubation and acceleration possibilities for start-ups in the field of biotechnology**
 - a. Beginning of closer cooperation and twinning with successful international incubators;
 - b. Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences;
- 3) **Developing a Network of mentors and investors in the field of biotechnology**
 - a. Start of greater and more systematic involvement of foreign experts and investors in developing local companies: trainings, seminars, consultations (jointly with Tartu University);
 - b. Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors.
- 4) **Participating in different expert visits, fairs and seminars.** During project period, there are planned several meetings, expert visits, fairs, training, informational days and seminars, what needs to be organized or attended by project team and target groups.

Tartu University

The Office of Research and Development (TTO) which is responsible for technology transfer in UT, serves several functions – the Office consists of Research Administration Unit, Research Project Unit, Intellectual Property Unit, Industrial Liaison Unit, and Career Unit. The mission of the TTO is to implement the scientific results created in the university by motivating faculty and industry to cooperate.

Key tasks and activities of Tartu University TTO are following:

- 1) **Organising networking events and study programs.**
 - a. Systematic attention on developing regular cooperation between technology transfer experts and universities, including involvement of experts in teaching technology transfer courses in the universities and making these courses more open for companies and inventors;
 - b. More attention on developing the network of mentors, deeper engagement of mentors;
 - c. Start of greater and more systematic involvement of foreign experts and investors in developing local companies: trainings, seminars, consultations (jointly with Tartu Biotechnology Park);
- 2) **Participating in studies about incubation and technology transfer in the region of Tartu.**
 - a. Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu (jointly with Department of Business Development of Tartu City and Tartu Biotechnology Park);
 - b. Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project) (jointly with Department of Business Development of Tartu City and Tartu Biotechnology Park).
- 3) **Attracting foreign companies and investments to the region of Tartu.**
 - a. Support for local companies to participate in international recognized venture capital and business angels' events (jointly with Department of Business Development of Tartu City and Tartu Biotechnology Park);
- 4) **Participating in different expert visits, fairs and seminars.** During project period, there are planned several meetings, expert visits, fairs, training, informational days and seminars, what needs to be organized or attended by project team and target groups.

3 Implementation plan

3.1 Aims of implementation

During this research, an assessment of the strengths and weaknesses of the technology transfer in biotechnology was conducted. Weaknesses:

- lack of information, cooperation possibilities;
- disunity of technology transfer sector;
- lack of financial incentives for the involved parties of the technology transfer processes;
- lack of venture capital in the region;
- small size of the technology transfer sector.

Strengths:

- the planned improvement of the process of identifying inventions;
- a good overview of other investment sources (mainly public funds);
- developing network of business angels and venture capitalists;
- biomed incubator in Tartu Biotechnology Park founded to enable starting companies in the field of biotechnology;
- idea lab in Tartu university for students and university start-ups;
- the number of supportive structures and organizations and other in technology transfer and increasing level of cooperation;
- The state-level favourable attitude towards entrepreneurship and biotechnology.

Insufficient cooperation between enterprises and universities as well as other R&D institutions can be explained by the structure of the Estonian economy, where a large proportion of enterprises operate in low added value niches, there is no considerable intramural RD&I in enterprises and therefore, the needs as well as capacity of enterprises for cooperation oriented towards knowledge and technology transfer with R&D institutions, is limited.

Therefore, besides increasing the knowledge and the amount of ideas with application value at universities and R&D institutions, it is at least equally important to increase enterprises' demand for development.

According to the weaknesses identified in the regional analysis the following aims have been defined to stimulate and improve technology transfer in biotechnology in Tartu region (with potential nationwide impact):

- Creating common aim for technology transfer.
- Strengthening the cooperation between companies, R&D institutions and business support structures involved in biotechnology to use more effectively existing and available resources.

- Improving the incubation services to foster and accelerate commercialisation of new ideas and inventions originating from R&D institutions, companies and citizens.
- Supporting the availability and utilisation of the pre-seed and seed funding (public and private resources).
- Raising awareness of technology transfer and incubation services to introduce available opportunities and support schemes.

3.2 Implementation plan by activities

In order to accelerate technology innovation and transfer, the joint efforts between the public and private sectors are inevitable. Four different actions are proposed for successful technology transfer in the Tartu area. They are following:

Action 1: Cooperation between companies, R&D institutions and business support structures;

Action 2: Incubation services;

Action 3: Availability and utilisation of the pre-seed and seed funding;

Action 4: Awareness of technology transfer and incubation services.

Action 1: Cooperation between companies, R&D institutions and business support structures

Description: Tartu is not a big city and therefore it is highly important to consolidate local resources. Biotechnology is seen as one of the key areas for Tartu in the future and therefore it is necessary to initiate and maintain strong cooperation between companies, R&D institutions and business support structures to be more competitive at international level, accelerate the development of new ideas and solutions, attract foreign investments and support growing companies.

Involved players:

- Tartu City Government
- Tartu Biotechnology Park
- Tartu University
- Estonian University of Life Sciences
- Tartu Science Park
- Companies, investors and financiers

Table 2. Work plan for Activity 1

Activity	Duration
Setting up a group of representatives of the organisations (companies, R&D institutions and business support structures) aimed at developing biotechnology and technology transfer in Tartu	2014
Start of regular meetings to share information (including new ideas and results from the science) and launch new initiatives for supporting technology transfer in biotechnology	2014
Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu	2014–2015
Start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan)	2015
Systematic attention on developing regular cooperation between technology transfer experts and universities, including involvement of experts in teaching technology transfer courses in the universities and making these courses more open for companies and inventors	2015–2016
Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project)	2015–2016

Budget: 20,000–50,000 EUR (per year) (see Appendix 7).

Action 2: Incubation services

Tartu is fortunate to have two science parks (Tartu Biotechnology Park, Tartu Science Park) providing accelerator and incubation services that are associated in developing entrepreneurship in biotechnology and life sciences. Tartu Biotechnology Park is the main incubator and provider of consultancy for biotechnology companies in Tartu. In order to continue successful work it is necessary to constantly improve the services offered.

Involved players:

- Tartu Biotechnology Park
- Tartu Science Park
- Tartu University
- Estonian University of Life Sciences
- Companies, investors and financiers
- Tartu City Government

Table 3. Work plan for Activity 2

Activity	Duration
Start of greater and more systematic involvement of foreign experts and investors in developing local companies: trainings, seminars, consultations	2014
Study about developing incubation services in the region of Tartu 2015–2020	2014–2015
More attention on developing the network of mentors, deeper engagement of mentors	2014
Increase of focus on internationalisation (e.g. study trips and roadshows in Europe, United States, Singapore, etc.)	2014–2015
Beginning of closer cooperation and twinning with successful international incubators.	2015–2016

Budget: 30,000–60,000 EUR (per year) (see Appendix 7).

Action 3: Availability and utilisation of the pre-seed and seed funding

Description: The biotech industry is not very prominent in the region of Tartu. However, the researchers and students of local universities have proved to be able to generate innovative ideas and launch dynamic start-ups. In order to support the further development it is important to create opportunities of pre-seed and seed funding.

Involved players:

- Tartu University
- Companies, investors and financiers
- Tartu City Government
- Tartu Biotechnology Park
- Tartu Science Park
- Estonian University of Life Sciences

Tabel 4. Work plan for Activity 3

Activity	Duration
Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences	2014–2015
Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors	2014–2015

Support for local companies to participate in international recognized venture capital and business angels' events	2014–2015
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Budget: 15,000–30,000 EUR (per year) (see Appendix 7).

Action 4: Awareness of technology transfer and incubation services

Description: In order to connect the ideas with the commercialisation potential with the specific knowledge about technology transfer and incubation it is necessary to raise continuously the awareness of available services and opportunities.

Involved players:

- Tartu Biotechnology Park
- Tartu Science Park
- Tartu University
- Estonian University of Life Sciences
- Companies, investors and financiers
- Tartu City Government

Table 5. Work plan for Activity 4

Activity	Duration
Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.	2014–2015
Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	2014–2015
Development of a modern website about the biotechnology sector in Tartu region	2015
Stronger and more proactive involvement in international technology transfer networks and projects	2015–2016

Budget: 25,000–35,000 EUR (per year) (see Appendix 7).

3.3 Main policy and action recommendations for technology transfer

The state can influence economic development and an environment promoting innovative business through taxes. The current fiscal policy of Estonia has been very successful in supporting business investments. However, its justification needs thorough analysis from the position of fostering the economy to reach the innovation-based development phase¹⁵, as this fiscal policy does not particularly promote knowledge intensive business, the recruitment of research and development personnel and investments creating the above average added value.

The state has to balance the risks, changes and subjective sense of danger brought along by the implementation of new technologies (for instance, the pressure on the Estonian language for using information technology or the hazards that genetically modified organisms pose to the natural environment). Therefore, the discussion between the society and science is more relevant than ever before.

In the field of technology transfer it is obvious that the main policy recommendations would concern opportunities how to encourage cooperation between companies and R&D institutions. In order to create and maintain favourable environment for that it is necessary to involve the government (at local and national level) as a third partner. In principle it embodies the classical concept of the triple helix of university-industry-government relationships. In addition, today's approach emphasises stronger engagement of citizens as a fourth partner which might also play important role for biotechnology by being a source of more user-driven innovation. Considering these implications the main policy recommendations are following:

- Systematic approach to develop biotechnology and set long-term goals to be achieved (important issue for policy makers at all levels – university, local, national and European Union).
- Decisions regarding development directions and goals (needs, available resources, etc.) should be knowledge-based using the input from relevant analyses and studies (university, local, national and EU level).
- Creating and maintaining measures that support and encourage entrepreneurship in universities (university, local, national and EU level).
- More focus on applied research and commercialisation of ideas originating from R&D institutions (university, national and EU level).

According to KNOWLEDGE-BASED ESTONIA Estonian Research and Development and Innovation Strategy 2007-2013 there are following suggestions for transfer of knowledge and technology:

- The development of **technology transfer units** at universities and higher education institutions, as well as the development of attitudes and skills promoting entrepreneurship and supporting the commercialization of research results among the members of universities

and higher education institutions will continue (SPINNO program). Flexible possibilities will be created for financing the prototype phase.

- New centres of competence will be established and the activities of the existing centres of competence in initiating and implementing long-term and market oriented collaboration projects in cooperation with enterprises and research and development institutions will be supported.

Other suggestions for technology transfer process are following:

- scientists should obtain better understanding of the technology transfer process (then they can take it into consideration when planning their study);
- scientists should communicate with colleagues/entrepreneurs about the project to get suggestions for other possible commercial applications (seminars, group-discussions, presentations, publications, trade-shows) and to get better understanding of who needs and benefits from the new technology (includes marketing people);
- environment that is supportive of entrepreneurship (encouraged by providing guidance, counselling and resources);
- new technology requires end-users to change their behaviour patterns, this might not happen quickly (marketing starts before new technology is available for users; projects need lots of publicity);
- clear legal framework regarding the creation and exploitation of IP from research is required;
- support measures (including funding) for strengthening cooperation between R&D institutions and companies (university, local, national and EU level).

Main Estonian legislative acts for biotechnology and technology transfer:

- Estonian Research and Development and Innovation Strategy 2014-2020 "Knowledge-based Estonia", webpage: http://www.hm.ee/sites/default/files/tai_strateegia.pdf
RD&I development overall objective is to create favourable conditions for the growth of productivity and standards of living, good education and culture.
- Organisation of Research and Development Act, webpage: <https://www.riigiteataja.ee/en/eli/525062014003/consolide>
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.
- Ministry of Education and Research development plan "Smart and Active People" 2015 – 2018, webpage: http://www.hm.ee/sites/default/files/tark_ja_tegus_rahvas_2015_2018_final.pdf

the development plan is outlined for each activity, and provides an overview of the content and scope of the strategic documents on which areas of the development is proposed.

- University of Tartu STRATEGIC PLAN 2015–2020 (A2020), webpage: http://www.ut.ee/sites/default/files/www_ut/11._tartu_ulikooli_arengukava_aastateks_2015-2020_a2020_terviktekst_0.pdf

The Strategic Plan is an important document for the university, as it maps out directions for development and principles to keep in mind.

- Development plan of the Estonian University of Life Sciences till 2015, webpage: <https://www.emu.ee/en/about-the-university/concept/development-plan-of-the-estonia-university/>

The Development Plan of the University till 2015 is a document that determines the over-all development of the University, its role in the society and specifies the main objectives in accomplishing its mission.

3.4 Barriers and opportunities for technology transfer

There are several barriers for technology transfer in biotechnology. Following subchapter observes closely barriers and offers opportunities for solving those barriers.

Intellectual property rights (IPRs). There is a general risk of information leakage to partners and/or competitors. Insufficient protection of IPRs can be a deterrent to international firms transferring technologies. Patenting can be a costly and time-consuming process.

To overcome these obstacle agreements between the different parties must be made explicit. Government should contribute to better understanding of the Intellectual Property Law and provide guidelines to help with legal problems.

Political instability in some countries might act as a deterrent to foreign investors, particularly where new commercial technologies are concerned.

Business environment and infrastructure. A changing regulatory environment, financial policy and bureaucracy are complicating the technology transfer. There is a need for greater regional cooperation among countries, both in R&D work and in the international commercial contracting network. Inadequate infrastructure may be the reason why technology transfer is not effective.

National governments have an important role to play in ensuring that the appropriate infrastructure is in place to foster technological development. Some developing countries need assistance to develop enabling environments of regulations, policies, and institutions.

Finance. High costs of managing joint research projects and access to capital is limited. Also, owing to the risks perceived for new technologies, financing costs will tend to be higher.

It is necessary for the finance community and the technology community to work together to study and decide which technologies to finance in what financial arrangements. Also developed countries should provide additional financial and other resources to developing countries for technological support geared towards adaptation and mitigation measures.

Public and private sector do not understand each other's role in the technology transfer process. Government intervention in technology transfer must recognize the central role that private investors play in the transfer process. In order to accelerate technology innovation and transfer, the joint efforts between the public and private sectors are inevitable.

Information barriers. Knowledge is poor about available technologies and financing opportunities and it will reduce demand for new technologies. Also there is a lack of awareness in the public and private sector.

It is necessary to improve the availability of information to all parties. Technology transfer offices should act as mediators; they could provide information about ongoing research projects, investment opportunities, business and community needs.

Attitudinal and cultural barriers. Fundamental differences in attitudes and values might be a reason for conflict that exists between the management of innovation and strategic business management. This conflict may inhibit communication between the various groups involved in technology transfer and reduce the likelihood of a successful outcome if not acknowledged and addressed. Information may be misinterpreted because of national and organizational cultural differences.

Research your counterpart's background and experience, enlist an adviser from your counterpart's culture and/or pay close attention to unfolding negotiation dynamics.

Market barriers. There is an average lag time of 5-10 years from product conception in a laboratory to commercialization and use because many good, new ideas are not accepted initially because of the basic human tendency to resist change and to resist moving outside of our own paradigms.

To accelerate the lag time local knowledge of different markets, local knowledge of demands and marketing management of new technologies are necessary. Also marketing the new and innovative product should start the same time when product development.

Finding the social, economic and technological barriers and opportunities in the developing countries for designing the technology transfer and innovation regime in climate change.

4 Communication plan

4.1 Communication objectives

The Tartu City Council together with Tartu Biotechnology Park, Tartu Science Park and other TT support organisations will form co-operation platform for increased competitiveness of the regional technology transfer. The communication plan will help to achieve maximum effect from joint efforts; it will ensure the awareness of targeted audiences about the activities along with emphasizing its cross-border dimension. To achieve expected impact of the project, publication and communication activities are chosen to secure possibly high awareness of the target group about the potential benefits of them, and with that extensive involvement of entrepreneurship. Direct target groups of the project are determined as:

- researchers and scientists from universities and research organisations;
- TTOs and TT experts;
- science and technology parks;
- educational organisations;
- entrepreneurs.

Means and channels of communication for all groups will be:

- sharing general information, calls for trainings and promotional events in public media nationally and regionally;
- communicating direct through existing contacts, special associations and organizations;
- sharing project related notifications and references on websites of the partner organisations;
- carrying out trainings, workshops, seminars, study visits and joint events;
- disseminating thematic printed leaflets, materials, publications.

Communication will be ensuring that information about the activities carried out and results achieved reach the appropriate audiences according to planned time schedule. All parties will contribute to make the information and know-how available to the interested parties and general public: universities and research organisations, researchers and students, science and technology parks, (bio)technology centres, incubators and accelerators, regional policy makers and wider audience. The major activities to transfer the results of planned activities to a wider audience can be brought out as:

- enabling free access to the technology transfer website, which contains information about relevant TT support organisations and possibilities;
- carrying out national communication campaigns to present new ideas, technology and research results for commercialization;
- organizing fairs for farmers and fruit producers to present their products;
- support networking by organizing regular meetings and supporting cooperation between companies, R&D institutions and business support structures;

- developing incubation services;
- developing the network of mentors;
- disseminating thematic printed leaflets, materials, publications and general information in public media, ensure coherency, accuracy and timeliness of all communication.

Other ideas for common marketing are:

- hosting an information sharing event on the topic that is relevant to your audience and that you each have expertise in. Each of you invites prospects from your own contact list and then split the costs of hosting the event;
- running a contest (ex. Start-up business contest) with prizes from all your partners;
- sharing a booth at trade shows, business expos or other events;
- publishing newsletters, which contains news, events, articles from each of the partners;
- exchanging text links or banners with other partners WebPages.

All aspects of the joint co-operation platform of the project are clearly linked with the needs and business activity of Estonian innovators, particularly SMEs, research institutions (universities etc.), TTOs and other business support organisations, addressing the shared problems and increasing the competitiveness of the regional innovators as a whole.

4.2 Communication strategy

Strategic focus is to secure networking, involvement of regional R&D institutions, business support structures and companies and the general planned impact of the project. Planned results of communication activities and promotion of local technology transfer possibilities is to acknowledge the target group of their benefit from the project. Public and interested parties have been informed about result of these activities.

Entry barriers for target market are quite high; the conducted surveys clearly show high interest on behalf of the target sector enterprises, universities and business angels. Selected partners have been operating for a long time and thus have established good contacts with target groups. This will ensure the creation of good relations between all target groups.

4.3 Communication plan

The following table gives a detailed overview of planned communication activities, target groups and communication channels.

Most of the communication activities contribute to the cross-border dimension and the sustainability of the technology transfer activities in the Tartu region.

Table 6. Communication activities

Milestone no.	Period	Activity	Outcome	Target groups	Communication channels
Milestone 1	9-12.14	Setting up a group of representatives of the organisations and start with regular meetings	Registered group of representatives of technology transfer in the region of Tartu. Meeting sessions every month.	Companies, R&D institutions, business support structures, researchers and students	International communication channels
		Starting with formation of coordinated action plan to attract foreign biotech companies	Coordinated action plan for the region of Tartu	Companies, R&D institutions, business support structures	Internal communication channels
		Starting with study about developing incubation services in the region of Tartu 2015–2020	Preliminary overview of European biotechnology incubators and accelerators	Incubations and accelerators in Tartu region, Tartu City Government	
		Organising first meeting in Tartu with business angels and venture capitalists focused on biotechnology and life sciences	First meeting is organised, at least 10 business angels and/or venture capitalist attended.	Business angels, venture capitalists, TTO and TT experts in Tartu region.	Incubators databases and networks, advertising in local media, on partner's web pages
		Organising study trip to Turku Science Park in Turku, Finland	Turku Science Park is visited and possible influence to the future activities is analyzed.	Incubators and accelerators, TT experts, Tartu City Government workers	
		Participating on GlobalBAW – Business Angels Week on 17.-23 November 2014 in	Prepare display and participate as exhibitors at GlobalBAW – Business	At least 6 participants from incubators and accelerators, TT	International communication channels

		Liechtenstein.	Angels Week has been visited and prepared display is presented to promote Tartu region and technology transfer opportunities.	experts, Tartu City Government workers.	
Milestone 2	1-4.15	Creating information materials about business opportunities in Tartu region for foreign companies	Project leaflets (1000pcs) are designed and printed in English, information is available also on Tartu City's and TBP homepages.		International communication channels
		Production of first set of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.	First set of short videos about companies and R&D institutions and business support structures involved in technology transfer are ready and presented on Tartu City's and Tartu Biotechnology Park (TBP) homepages	Companies, R&D institutions, business support structures	
		Beginning of closer cooperation and twinning with successful international incubators. Selecting suitable incubators from Europe, USA and from Singapore and Japan.	First selection and connections with incubators are made and first meetings are organised.	Incubators and accelerators, TT experts, Tartu City Government workers	
		Starting with development of a modern website about the	By the end of milestone 4, a modern webpage is ready to	Companies, R&D institutions, business	

		biotechnology sector in Tartu region	present technology transfer possibilities in biotechnology.	support structures, researchers and students	channels
Milestone 3	5-8.15	Study about developing incubation services in the region of Tartu 2015–2020	Study about incubation services in the region of Tartu is ready and summary is published in the TBP, Tartu City Government and Tartu University WebPages.		International communication channels
		Participating on 2015 National Angel Summit	Prepare display and participate as exhibitors at 2015 National Angels Summit have been visited, prepared display is presented to promote Tartu region and technology transfer opportunities.	At least 6 participants from incubators and accelerators, TT experts, Tartu City Government workers.	Internal communication channels
		Participating at Gathering of Angels Meeting in USA in May 2015.	Participate as visitors at Gathering of Angels Meeting in USA in May 2015 to exchange top level know-how and bring new technology transfer knowledge into the region.	At least 6 participants from incubators and accelerators, TT experts, Tartu City Government workers.	

		Launching newspaper articles about the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	Newspaper article are launched and technology transfer objectives are published.	Tartu City Government, biotechnology & technology transfer companies and R&D institutions	International communication channels
		Preparing information material for target groups and public in Estonia and abroad	Project leaflets (1000pcs) are designed and printed in English and Estonian.	Start-ups, students, entrepreneurs, public	Available client databases.
Milestone 4	9-12.15	Launching the Invest in Tartu web-page and press release through sectoral organizations (Tartu City Government, Tartu Biotechnology Park, universities) in public media in Estonia.	Web-page in Estonian and English with active communication environment is available for public use. Target group and public have been informed about the main objectives.	At least 10 members in the field of technology transfer by the end of 2016.	Available client databases, advertising in local media, local biotechnology associations and partner's web pages.
		Launching newspaper articles about the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	Newspaper article are launched and technology transfer objectives are published.	Tartu City Government, biotechnology & technology transfer companies, R&D institutions	International communication channels
		Organising study trip to Singapore	Singapore main biotechnology centres are visited and possible influence to the future activities is analyzed.	Incubators and accelerators, TT experts, Tartu City Government workers	Incubators databases and networks, advertising in local media, on

					partner's web pages
		Production of set of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.	Set of short videos about companies and R&D institutions and business support structures involved in technology transfer are ready and presented on Tartu City's, TBP and Invest in Tartu homepages	Companies, R&D institutions, business support structures	International communication channels
Milestone 5	1-4.16	Organising systematic counselling sessions for start-ups and biotechnology companies to increase their investment readiness and organise regular meetings with potential investors.	At least 15 counselling sessions and 3 meetings with investors are organised.	At least 15 members in the field of technology transfer by the end of 2016.	Incubators databases and networks, advertising in local media, on partner's web pages
		Organising study trip to Oslo University Innovation Park	Oslo University Innovation Park is visited and possible influence to the future activities is analyzed.	Incubators and accelerators, TT experts, Tartu City Government workers	International communication channels
Milestone 6	5-8.16	Preparing and carrying out communication campaign to promote technology transfer possibilities in Tartu region.	Marketing campaign has been carried out, informational leaflets (at least 100pcs) distributed to target group and interested parties.	Farmers, end consumers and food industries	Available client databases, advertising in local media, on partner's web pages and Invest

					in Tartu web page.
		Launching radio show about the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	Radio show is launched and technology transfer objectives are published.	Tartu City Government, biotechnology & technology transfer companies and R&D institutions	International communication channels
		Organising study trip to Lund University in Lund, Sweden.	Lund University and its incubator and accelerator are visited and possible influence to the future activities is analyzed.	Incubators and accelerators, TT experts, Tartu City Government workers	Incubators databases and networks, advertising in local media
Milestone 7	9-12.16	Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu	Coordinated action plan is formed for attracting foreign biotech companies to the region of Tartu.	Foreign biotechnology & technology transfer companies and R&D institutions	International communication channels
		Launching newspaper and journal articles about the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	Newspaper article are launched and technology transfer objectives are published.	Tartu City Government, biotechnology & technology transfer companies and R&D institutions	
		Organising study trip to London BioScience Innovation Centre in London, England	London BioScience Innovation Centre is visited and possible influence to the future activities is analyzed.	Incubators and accelerators, TT experts, Tartu City Government workers	

4.4 Detailed overview of communication activities

The following table give an overview about planned promotion activities.

Table 7. Promotion of technology transfer in the region of Tartu

Activity	Description
Web page	Web page contains helpful materials on both theoretical and practical levels. In 2 languages (EST; ENG) for public use, prepared to be fully administrable later by the Tartu City Government, Tartu Biotechnology Park and Tartu University.
Innovation and technology transfer database	Information about existing and potential start-ups, research results and TTO support organisation in the region. It will include contact information, fields of activity and preparation of different groups.
Promotion of information seminars and trainings	Necessary invitations are produced; information shall be made available in selected newspapers and on relevant web pages.
Promotional leaflets	2 leaflets shall be produced, one in English and one in Estonian, 500 in each language. Leaflets contain information about the technology transfer possibilities and support organisations and its services on 2 pages (format A5). The leaflets shall be printed on paper, using 2-colour print.
Promotional material for trade fairs, exhibits, conferences, seminars	Two sets for exhibits shall be produced - one in English and the other in Estonian. Size of displays – 2x4 meters.
Organizing technology transfer information fairs in Tartu region	1-day promotional event has been carried out, at least 25 start-ups, researchers and other interested parties attended, printed project leaflets distributed to participants and interested parties. Estonian (in Tartu region) start-ups and researchers, business support organizations and group of key investors will present best examples of technology transfer practice.
Preparing and carrying out communication campaign	Prepare and carry out communication campaign to promote technology transfer possibilities and information in Estonia, especially in Tartu region.

For common marketing, a website named Invest in Tartu will be created. Most important mission for Invest in Tartu is to connect international companies with business opportunities in Tartu and to help local companies to internationalize their business. Invest in Tartu should have contact network which includes local government agencies, chambers of commerce, professional services, and businesses of all sizes to put foreign investors in touch with the right people at the right time. Invest in Tartu has its own homepage (similar to <http://www.investinestonia.com/en/>), but with the focus on Tartu region. Information on homepage should include similar information like here: <http://business.tartu.ee/> and also provide any kind of information about starting and registering companies and local policy of taxes and accountancy, will help to prepare foundation documents and other certain documents (applications, agreements etc.) submitted to the Commercial Register.

To promote business in Tartu, Invest in Tartu is participating in various events with presentation booth. In the booth, there are several expositions to promote and introduce different aspects of Tartu. Display of general information about Tartu to describe and give a short overview about regional history. Also there are listed out which are the strengths of Tartu region (for example the same ones as listed here: <http://business.tartu.ee/reasons-to-choose-tartu>) and what is the location of Tartu in Estonia (both geographically and economically). Another display presents how Invest in Tartu can help foreign investors to collaborate with entrepreneurs from Tartu. This will provide information about business environment, legal and financial questions and contact network. Third display is to promote universities in Tartu (Tartu University, Estonian University of Life Sciences); goal is to give short overview about science in Tartu (scientists, main research areas, most important discoveries, etc). Next display is for key sectors in Tartu, there are 5 main sectors - Metal Processing and Machine Building Sector, IT Sector, Wood Sector, Biotechnology sector and Food Industry. Display shows leading companies, research and support organisations, economic indicators and main contacts of each sector.

Table 8. Promotion of Tartu region to the target group

Activity	Description
Articles in general interest magazines (Eesti Arst, Science Illustrated, Director, Baltic Business News etc.). Detailed list of magazines will be finalized during first months of milestone I.	5 articles in English and in Estonia. 2 articles shall be focused on general information and promotion about the benefits of new technology transfer website, 3 shall be interviews with leading researchers and investors in the regions.
Organization of communication and networking seminars for sharing information about technology transfer	At least 4 specialists will organize and prepare for those seminars (using pre-produced leaflets and exhibit materials of model).

<p>Participating on 2015 National Angel Summit. Industry leaders and startup CEOs from across North America and around the world will be debating the trends for investing in and supporting early-stage companies in Canada. Participants can increase their network with experienced investors, venture capitalists and other industry leaders, meet prospective co-investors for their portfolio companies and discover national best practices that lead to investor success.</p>	<p>Prepare display and participate as exhibitors at 2015 National Angels Summit have been visited and prepared display is presented to promote Tartu region and technology transfer opportunities.</p>
<p>Participating on GlobalBAW – Business Angels Week on 17.-23 November 2014 in Liechtenstein. The Investors’ Summit Liechtenstein offers a unique networking platform for decision-makers of the old and new economy, provides an exclusive framework for the presentation and discussion of current economic trends and topics, grants entrepreneurs access to a top quality group of investors and offers investors selective investment opportunities and perceives itself as a matchmaker between investors and companies searching for capital.</p>	<p>Prepare display and participate as exhibitors at GlobalBAW – Business Angels Week has been visited and prepared display is presented to promote Tartu region and technology transfer opportunities.</p>
<p>Participating at Gathering of Angels Meeting in USA in May 2015. Gathering of Angels is a monthly gathering of entrepreneurs looking for capital and Angels Investors looking for investment opportunities. All will engage in a pre-selected lineup of presentations geared towards raising seed capital and benefiting from valuable feedback from investors.</p>	<p>Participate as visitors at Gathering of Angels Meeting in USA in May 2015 to exchange top level know-how and bring new technology transfer knowledge into the region.</p>

4.5 Overview of follow-up communication activities

A detailed communication plan for next 5 years will be part of the development plans for the biotechnology transfer sector in the Tartu region.

With the follow-up communication activities the continuity shall be achieved – feedback from the target groups will be used in planning and carrying out improved training and web-based tool introducing in the future. For acquiring this result, surveys will be conducted on yearly basis.

The annual cost of follow-up communication activities will be approximately 5,000 – 8,000 EUR per year (covering communication and updating activities of TT information) and will be covered jointly by Tartu City Government, Tartu University TTO office and Tartu Biotechnology Park.

5 Budget and financial possibilities for technology transfer

5.1 Budgets of activities

There are all together 4 different action plans composed and following subchapter will give an overview of planned costs. Total budget is available in appendix 7.

Action 1 contains six different actions (see table 9):

- setting up a group of representatives of the organisations;
- start of regular meetings;
- formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu;
- start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan);
- systematic attention on developing regular cooperation between technology transfer experts and universities;
- formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu (composing action plan, meetings, workgroups).

Table 9. Budget of Action 1

	2014	2015	2016
	Total	Total	Total
Action 1: Cooperation between companies, R&D institutions and business support structures			
Setting up a group of representatives of the organisations (e-mails, meetings)	450	0	0
Start of regular meetings (materials, coffee breaks)	450	0	0
Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu (composing action plan, meetings, workgroups)	0	12,000	0
Start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan)	0	8,000	0
Systematic attention on developing regular cooperation between technology transfer experts and universities(preparation works, material printing, meetings)	0	2,800	8,400
Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project)	0	10,000	4,0000
SUM	900	32,800	48,400

Setting up a group of representatives of the organisations and start with regular meetings needs covering of following costs: mobile phone bills, internet connection, meeting room rental fees and catering, creation of informational materials (printed leaflets).

Formation of coordinated action plan need covering of consultations (with experts) and formulation of plan (labour costs), also meeting room rent and catering, materials for meetings.

Start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan) needs first creation of common marketing and informative materials, also planning of common website for technology transfer information.

Systematic attention on developing regular cooperation between technology transfer experts and universities needs covering of travelling costs (visiting different fairs, trades, biotechnology incubators and science parks) and organizing meetings.

Formation of a wider Biotechnology Development Plan for the region of Tartu main costs are for consultations (TT experts and mentors) and organisational costs of meetings with workgroups, group of representatives, experts and mentors (meeting room rent, printed materials and office supplies).

Action 2 contains five different actions (see table 10):

- start of greater and more systematic involvement of foreign experts and investors in developing local companies;
- study about developing incubation services in the region of Tartu 2015–2020;
- more attention on developing the network of mentors, deeper engagement of mentors;
- increase of focus on internationalization;
- beginning of closer cooperation and twinning with successful international incubators.

Table 10. Budget of Action 2 (2014 – 2016)

	2014	2015	2016
	Total	Total	Total
Action 2. Incubation services			
Start of greater and more systematic involvement of foreign experts and investors in developing local companies	2,600	0	0
Study about developing incubation services in the region of Tartu 2015–2020	5,000	10,000	0
More attention on developing the network of mentors, deeper engagement of mentors	2,500	1,000	0
Increase of focus on internationalisation (e.g. study trips and roadshows in Europe, United States, Singapore, etc.)	3,000	41,000	0

Beginning of closer cooperation and twinning with successful international incubators (visits, webinar platform rent, common marketing materials etc.)	0	5,300	19,000
SUM	13,100	57,300	19,000

Start of greater and more systematic involvement of foreign experts and investors in developing local companies is planned to start and fulfil in 2014 and involves organizing meetings and workshops with foreign experts and investors (mainly through Skype and e-mail), finding suitable investor groups for local companies (fees and other participation costs).

Study about developing incubation services in the region of Tartu 2015–2020 includes costs of consultation (composing) and organising meetings with work groups and TT experts, also with other incubators and accelerators.

More attention on developing the network of mentors, deeper engagement of mentors needs paying for organizing meetings (meeting room rent, materials and office supplies), also in some cases paying for mentors consultations and/or travelling (highly valued local mentors, foreign mentors).

Increases of focus on internationalization costs are mainly travelling costs: study trips and roadshows in Europe, United States, and Singapore. Also, creating informational materials and gifts is necessary for creating marketing value.

Beginning of closer cooperation and twinning with successful international incubators (visits, webinar platform rent, common marketing materials etc.) main costs are travelling and marketing materials, also labour costs for writing analyses and reports.

Action 3 contains three different actions (see table 11):

- stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences;
- organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors;
- support for local companies to participate in international recognized venture capital and business angels' events.

Table 11. Budget of Action 3 (2014 – 2016)

	2014	2015	2016
	Total	Total	Total
Action 3: Availability and utilisation of the pre-seed and seed funding			
Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists	4,300	13,500	<i>0</i>

focused on biotechnology and life sciences (fees, meetings, travelling, materials etc.)			
Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors (events, meetings, preparation courses, consultations)	0	12,500	<i>5,000</i>
Support for local companies to participate in international recognized venture capital and business angels' events	1,000	6,500	<i>5,000</i>
SUM	1,200	32,500	<i>10,000</i>

Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences: main costs are different fees (participation fees in trades, belonging into some kind of network etc.), travelling (visiting different biotechnology centres, meetings with business angels and venture capitalists), organizing local meetings (room rent, catering, materials and office supplies) and also creating and printing informational materials.

Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors includes different stages: first, selection of start-ups and companies and counselling sessions for target groups, after preparation period organizing meetings with investors. Main costs are labour costs for selection board, organisers and consultants, travel costs for investors, entrepreneurs and consultants and event costs like room rent, catering, informational materials etc.

Support for local companies to participate in international recognized venture capital and business angels' events include mainly covering travelling costs and covering participation fees for companies.

Action 4 contains four different actions (see table 12):

- regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.;
- start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology;
- development of a modern website about the biotechnology sector in Tartu region;
- stronger and more proactive involvement in international technology transfer networks and projects.

Table 12. Budget of Action 4 (2014 – 2016)

	2014	2015	2016
	Total	Total	Total
Action 4: Awareness of technology transfer and incubation services			
Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.	0	15,500	<i>8,000</i>
Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology	2,000	5,100	<i>2,800</i>
Development of a modern website about the biotechnology sector in Tartu region	0	4,000	<i>0</i>
Stronger and more proactive involvement in international technology transfer networks and projects (fees, trades, commercial materials)	0	2,500	<i>16,500</i>
SUM	2,000	27,100	<i>27,300</i>

Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc. include payments for producing company and organizers (labour costs, office supplies and other direct and indirect costs). Also, suitable local travelling costs are covered.

Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology. During this activity, at least 4 newspaper or journal articles are produced and at least 2 radio shows are hosted. Main costs are labour costs (organizer, journalist) and publication costs.

Development of a modern website about the biotechnology sector in Tartu region main costs are development costs of platform (IT company fees) and creating texts to homepage (labour costs). Also, registration of webpage brand and homepage name is necessary (Invest in Tartu) and corresponding fees should be covered.

Stronger and more proactive involvement in international technology transfer networks and projects main costs are fees for participating in different networks and trade shows.

5.2 Funding opportunities

For implementing technology transfer activities in the field of biotechnology, there are several funding possibilities from European Union funds (see table 13). In cooperation with Tartu City Government, following three programs are most suitable:

- Horizon 2020 (opened, closes in 17th December 2014);
- Programme for the Competitiveness of Enterprises and SMEs (COSME) (Calls for different projects between 19.08.2014 – 29.10.2014);
- Eurostars (different calls).

The Tartu City Government will organize the application documentation in cooperation with selected partners (see subchapter 2.3).

Table 13. EU funding possibilities

Program	Description	Funding	Deadline
Horizon 2020	Supports SMEs with a new instrument that runs throughout various funded research and innovation fields	Phase I: EUR 50,000 (lump sum) per project (70% of total cost of the project) Phase II: an amount in the indicative range of EUR 500,000 and 2,5 million (70% of total cost of the project as a general rule)	17.12.14
Programme for the Competitiveness of Enterprises and SMEs (COSME)	Facilitate SME access to finance, create supportive environment for business creation, help small businesses operate outside their home countries and improve their access to markets	Up to 60 % for a maximum EU funding of EUR 200 000	Calls for different projects between 19.08.2014 – 29.10.2014
EUREKA	Aims at raising the productivity and competitiveness of businesses through technology. It supports SMEs, companies and technology related organisations through various clusters, networks and individual projects	In 2014 there is no public support foreseen for Estonian organisations wishing to participate in Eureka! Individual or cluster projects, participation is possible only by declaring self-funding	Individual project calls are open for all year long
The Innovative	Aiming to speed up the	From the European	12 .11.2014

Medicines Initiative (IMI)	development of better and safer medicines for patients. IMI supports collaborative research projects and builds networks of industrial and academic experts in order to boost pharmaceutical innovation in Europe	Commissions' seventh framework programme for research, which is matched by mostly in-kind contributions, provided by the research-based pharmaceutical companies that are members of EFPIA	
Eurostars	Supports research-performing small and medium enterprises, which develop innovative products, processes and services, to gain competitive advantage. It is a transnational programme, where projects have partners from two or more Eurostars countries.	In 2014 there is no public support foreseen for Estonian organisations wishing to participate in Eureka! Individual or cluster projects, participation is possible only by declaring self-funding	

Also, there are some funding possibilities from Estonian EU funds (see table 14). Some examples for using those programs:

- after formulating a group of representatives of TT, registering them as a cluster and using a cluster development program for starting and implementing planned activities (meetings, informational materials, visibility etc.); or
- use Competence Centres Programme for implementing planned activities. Programme is promoting co-operation between research institutions and companies to enhance international competitiveness of enterprises, so it is suitable for TT activities.
- in co-operation with “start-up Estonia” organise planned activities like meetings with mentors and investors, common study programs etc.;
- promoting the use of Production Corporate Development Grant among start-ups and biotech companies. The grant will fund development activities for new products and services, or processes.

Table 14. Funding possibilities in Estonia for technology transfer in biotechnology

Program	Description	Fund	Webpage
Development employee involvement	Development employee involvement is designed to enhance the international competitiveness of enterprises.	EAS	http://www.eas.ee/et/ettevotjale/ettevotte-arendamine/arendustoeoetaja-kaasamise-toetamine/arendustoeoetaja-kaasamise-toetus
Cluster development program	Program objectives are to increase the added value of new products and services and export sales and to promote cooperation between the different sectors and between enterprises and between enterprises and research institutes.	EAS	http://www.eas.ee/et/ettevotjale/ettevotte-arendamine/klastrite-arendamise-programm/uldist
EAS Product Development Master Class	The three-month development program will help businesses to create new competitive product solutions.	EAS	http://www.eas.ee/et/ettevotjale/innovatsioon/tootearenduse-meistriklass/uldist
The high-potential, innovative companies developing the program "Start-up Estonia"	Start-up Estonia program helps to develop Estonian start-up ecosystem	EAS	http://www.eas.ee/et/alustavale-ettevotjale/eas-i-lahendused-ja-toetusvoimalused/start-up-eessti/ueldist
Competence Centres Programme	Programme is promoting cooperation between research institutions and companies to enhance international competitiveness of enterprises.	EAS	http://www.eas.ee/et/ettevotjale/innovatsioon/tehnoloogia-arenduskeskuste-programm/ueldjutt
Innovation units	Program's goal is to strengthen cooperation between enterprises and external innovation partners.	EAS	http://www.eas.ee/et/ettevotjale/innovatsioon/innovatsiooniosakud/uldist
Production Corporate Development Grant	The grant will fund development activities for new products and services, or processes.	EAS	http://www.eas.ee/et/ettevotjale/innovatsioon/tootmisettevotte-innovatsioonitoetus/uldist

5.3 Overview of socio-economic impact

In Estonia there are almost 100 companies working in the field of biotechnology and this number is still growing. Most of them are located in Tallinn or Tartu. University of Tartu, Tallinn University of Technology and Estonian University of Life Sciences are the most significant educational institutions in the field of biotechnology in the country. The country has launched the National Biotechnology Programme for 2010-2013 with the priority emphasis on the areas of food processing, development of functional food, molecular diagnostics and drug discovery technologies. These areas are also supported by Business Incubation Programme and Innovation Voucher Grant.

The innovation and technology transfer in biotechnology sector has rapidly grown in Estonia during the past years. However, compared to European Union average indicators, there is still a long way to go until we can reach similar levels in commercialisation, production, processing and consumption. Companies, who actively are involved with biotechnological research, innovation, production or business support and investment, are relatively small in Estonia and lacking of international experiences. Technology transfer is an important factor in building economies. It is a young area where there are many opportunities to discover and to shape the interactions between universities and the private sector. Technology transfer will make the creativity of researchers available to the public and will create a link between academia and the public sectors.

Aforementioned activities will give a very good foundation where to build efficient and practical technology transfer community, which is suitable for the region. That will in turn improve the quality and efficiency of knowledge and technology transfer. The economic outcome of public and private sector is considered to be the key factor for regional development.

Economic-impact studies can play a valuable role in affirming the societal value of public research institutions and their technology-transfer activities. They can confirm that these institutions substantially benefit society through converting their inventions into new products and services. General welfare of its inhabitants is one of the most relevant concerns of every regional unit. Therefore improvement of socio-economic conditions that enable regions to achieve higher competitiveness beneficial to their inhabitants, are vital to regional development. The planned activities toward better technology transfer will help to achieve the following goals of regional development, ensuring higher living standards and better working conditions for its inhabitants. Examples of what science and innovation should achieve are:

- brings in more capital and investments;
- complements and integrates other sectors of the economy;
- allows to increase exports;
- increases levels of employment (directly and indirectly);
- brings new products to the market;
- improves overall health of the population.

Appendix 1: Glossary of terms used with technology transfer

Added value – an indicator used in assessing the efficiency of activities of an enterprise or an economic sector, which includes employment costs, depreciation or costs made for replacing fixed assets and residual revenue or profit.

Applied research – original investigation undertaken in order to acquire new knowledge; directed primarily towards solving a specific practical problem within a relatively short period of time.

Background Patent - A patent that was in existence prior to a Cooperative Research and Development Agreement or CRADA, i.e. the invention described and claimed in the patent must have been conceived outside of the CRADA and not first actually reduced to practice under the CRADA.

Base-line funding – financing of research and development in order to attain strategic development objectives of research and development institutions, particularly to co-finance foreign and national projects and open new research directions.

Basic research – theoretical or experimental work undertaken in order to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Centre of competence – a centre, which activities are mainly oriented to applied research, development and implementation of global know-how as well as on the basis of these activities increasing the competitiveness of enterprises in this sector.

Centre of excellence in research – a research centre that has international recognition in its field of research. A centre of excellence may consist of one or more research groups who have a clearly defined common research target and management structure. Activities of a centre of excellence are mainly directed towards basic research in fields that are relevant to the country's development and are preferably also related to Doctoral studies. The Ministry of Education and Research will give the status of the Centre of Excellence together with additional financing.

Cluster / economic cluster – network of cooperation, exchange of information and interaction of enterprises and institutions in one sector (e.g. education and research institutions, local government, business enterprises).

Commercialization (using for commercial purposes) – marketing an innovative product, technology or process; selling intellectual property or the right to use it.

Contractor - Any person, small business firm, or nonprofit organization that is a party to a funding agreement.

Field-of-use - A specific area of use for which an exclusive license to a patent may be granted, for example, a specific market area such as biomedical or graphic arts.

Foresight – a process of vision creation, which is systematic, involves different stakeholders, looks into the future and has a mid-term and a long-term prospect. The aim of foresight is to influence present decisions and planning joint activities.

Grant financing – resources from the state budget to finance research (including post-doc) grants. OECD definition it includes chemicals (NACE23 24), machinery and equipment (NACE 29), office machinery and equipment (NACE 30), electrical machinery and apparatus (NACE 31), radio, television and communication equipment (NACE 32), medical, precision and optical instruments (NACE 33), cars (NACE 34), planes and other transport equipment (NACE 35), post and telecommunications (NACE 64), information technology including software development (NACE 72), research and development services (NACE 73).

Innovation – utilization of new ideas in order to: 1) market a competitive product or service; 2) rearrange internal processes of the organization (production, marketing, delivery, management, etc.); 3) utilizing a new or significantly improved technology in industry, services or public sector. Innovation has the following sub-types:

- **product innovation** – a product or service that differs significantly from enterprise's current products by its qualities or exploitation;
- **process innovation** – utilizing a new or significantly improved production process, delivery method or production support activity with the aim of increasing product quality, efficiency and/or flexibility of production or its support activities, the level of environmental sustainability or security;
- **organizational innovation** – introducing significant changes in enterprise's business practice, job structure or communication with other enterprises and institutions in order to increase enterprise's innovation capacity and improve economic indicators (quality, efficiency); **market innovation** – introducing significant changes in marketing enterprise's products and services, including changes in design and packaging;
- **technological innovation** – innovation related to the development and implementation of new technological solutions;
- **Non-technological innovation** – innovation, which will not bring about technological changes (mainly organizational and market innovation).

Innovation investments and expenditures – enterprise expenditures on the following articles/activities: 1) intramural research and development (carried out by enterprise's employees); 2) extramural research and development; 3) purchasing machinery, equipment and software; 4) acquiring other sorts of extramural knowledge (patents, unpatented inventions, know-how or attaining other knowledge (licensing from other enterprises or institutions)); 5) training of

employees; 6) marketing innovations; 7) other kinds of preparatory activities for developing new or significantly improved products and processes.

Innovation support structures – institutions, which main aim is to support the implementation of outcomes of research and development on commercial purposes. Innovation support structures include science and technology parks, technology and innovation and incubation centres, technology transfer divisions of universities and professional higher education institutions, etc.

Innovator - in a general sense, is a person or an organization who is one of the first to introduce into reality something better than before. That opens up a new area for others and achieves an innovation.

Intellectual Property - Intangible property, including ideas, processes, and discoveries that is protected by a patent, trademark, copyright, trade secret, or other means. The rights to this property can be bought and sold, leased or rented, or otherwise transferred between parties in much the same way that rights to real property or other personal property can be transferred.

Internationalization – export of products and services, receiving and making foreign investments (start-up of branches in other countries, acquiring a holding in a foreign company), participating in international programs and cooperation networks.

Invention - A discovery, new device or process developed from study, research and/or experimentation that is or may be patentable under Title 17 of the United States Code (U.S.C.).

Key technologies – research intensive and quickly developing groups of technologies with many application possibilities outside of their field.

Knowledge and technology intensive enterprise – an enterprise that closely collaborates with R&D institutions and develops innovative products, services or technologies which are based on state-of-the-art scientific data and/or which investments in research and development exceed 5% of enterprise's turnover and/or which places a lot of emphasis in its activities on creating and managing intellectual property and/or which employees' education level is high and a significant part of the labour force consists of employees engaged in research and development.

Knowledge and technology transfer – transfer of knowledge and technologies from a creator to a user or from one user to another, implementing knowledge and technologies created in one country and/or company in other institutions and/or countries for introducing new products, technologies and services. Knowledge transfer is mainly based on mobility of people between enterprises or between enterprises and research and development institutions. In technology transfer, in addition to mobility of people, the transfer of property rights or the right to use intellectual property from an owner to a client or a user is a very important factor.

License - Generally, a legal right, less than a title, which entitles the possessor to use, make or sell the particular subject matter under consideration. For technology transfer purposes, a license

usually covers a patented invention, a trademarked/service marked product or service, a copyrighted work, protected data, or a trade secret. Licenses can be negotiated on a geographical or field-of-use (specific use area) basis.

Made - In relation to any invention or copyright, it means the conception or first actual reduction to practice.

Partners - The party(s) working with a Federal laboratory in a partnership or Cooperative Research and Development Agreement (CRADA). Also referred to as “collaborators.”

Patent - A grant from the Federal Government to an inventor wherein, in exchange for the inventor providing an enabling disclosure of the invention and complying with other legal requirements, the Government awards the inventor with the right to exclude others from making, using, or selling the claimed invention, in the United States, for 20 years from the date of patent application. In foreign countries, the term of the patent may vary somewhat.

Practical application - To manufacture (in the case of a composition or product), to practice (in the case of a process or method), or to operate (in the case of a machine or system); and in each case, under such conditions as to establish that the invention is being utilized and that its benefits are available to the public on reasonable terms to the extent permitted by law or government regulations.

Proprietary Information - Within a CRADA, information owned by the partner prior to the formation of the CRADA and so designated. Proprietary information embodies trade secrets developed at private expense and commercial or financial information that is privileged or confidential under the Freedom of Information Act. For such information to be afforded legal protection, it should be recorded and marked as proprietary when it is first introduced for use in a CRADA activity.

Protected Data - For technology transfer purposes, protected data are commercially-valuable data that are withheld from dissemination to the public. These are data generated and developed under a CRADA.

Research and development (R&D) – systematic activity based on person’s freedom of creation, which aim is to acquire new knowledge on humans, nature and society and their mutual effects using scientific research and applying this knowledge. Research and development includes basic research, applied research and experimental development, which may also partially overlap.

Research and development, and innovation (RD&I) – in addition to research and development, it includes activities in the enterprise related to marketing of outcome of R&D and other innovations (introduction of technologies, improvements in processes and work arrangement, etc.

Research and development institutions – institutions and legal persons, which principal activity is research and development and that are registered pursuant to the Research and Development Organization Act § 51.

Research and development programs – these are intended for developing the areas that are important from the perspective of the key technologies of the RD&I strategy and socio-economic and cultural development of the country as well as to conduct necessary research for developing and implementing government's policy in this area.

Targeted financing – financing of research and development institutions based on research themes.

Technology – knowledge, skills and information materialized in machinery and equipment and in the non-material manner in human capital.

Technology foresight – implementing foresight based on technology trends, formulating structured expectations and projections for technological developments and needs in the future. In addition to foresight of development trends, technology foresight includes setting strategic objectives for technological development of economy, defining consensual opinions on development objectives of the society and dissemination of these opinions.

Technology transfer division – structural divisions at universities and in other R&D institutions, which main task is to commercialize the intellectual property created in the institution and developing cooperation between the institution and enterprises.

Title - A legal right of ownership to tangible or intangible property.

Trade Secret - Legally withheld commercial formula, device, pattern, process, or information that affords a business an advantage over others who do not have the secret.

Trademark - A legally-recognized, unique expression that identifies the source of goods for commercial purposes.

Appendix 2. International technology transfer networks

International Technology Transfer Network (ITTN)

<http://en.ittn.cn/sites/english/index.html>

China

ITTN, guided and sponsored by Beijing Municipal Science and Technology Commission, organized under the necessity of promoting international technology transfer and joint growth by overcoming conflicts through the region-to-region cooperation. China emerging industries are new energy, energy-saving & environment-friendly, new energy vehicle, new material, bio-pharm, advanced equipment manufacturing, new generation of IT, and modern agri-tech, etc. As a supporting partner of ITTN, starting company will enjoy technology introduction, networking and partnering service for your technology transfer and commercialization project by match-making with Chinese public corporation and private company, university and research institute, science park and industrial cluster, incubator and venture capital, etc.

TTI – The Global Gateway to Innovation

<http://www.tii.org/>

Luxembourg

TII brings together innovation and technology consultants, technology brokers and intellectual asset advisors, university and research centre transfer offices, regional development agencies and chambers of commerce, science parks, innovation centres and incubators, contract research organizations and engineering consultants, government ministries and agencies and sectoral professional organizations. This is TII's wealth and strength; all of its members are promoting or providing high quality innovation support and technology transfer services to firms, with the ultimate aim to develop the knowledge economy and boost the wealth creation process.

Shanghai International Technology Transfer Network (SITTNet) -

<http://www.sittnet.cn/link.aspx>

China

Lead by Science and Technology Commission of Shanghai Municipality, Shanghai International Technology Transfer Network, was co-founded in 2004. SITTNet is a part of Shanghai R&D public service platform system. The mission of SITTNet is to integrate resources of organizations dealing with international technology transfer, promote the cooperation among industry, academy and research organization, elevate the flow efficiency of S&T resources and accelerate the technology exchange and high-tech product trade regionally or internationally.

ASTP-Proton

<http://www.astp-proton.eu/>

Leiden, Netherlands

ASTP-Proton is the premier, pan-European association for professionals involved in knowledge transfer between universities and industry. By promoting and professionalizing knowledge transfer practice, the association aims to enhance the impact of public research on society and the economy. ASTP-Proton is a non-profit organization; it is focusing on knowledge transfer professionals and on knowledge and technology transfer offices by establishing and exchanging best practices for knowledge and technology transfer and training of professionals. In addition, ASTP-Proton is a cooperative platform for various national networks for knowledge transfer in Europe. ASTP-Proton also represents the interests of its members at the European level in innovation and technology transfer policies and other relevant matters

European association of research and technology organizations (EARTO)

<http://www.earto.eu/>

Brussels

EARTO is a non-profit international association established in Brussels. EARTO mission is to promote and defend the interests of research and technology organizations (RTOs) in Europe by reinforcing their profile and position as a key player in the minds of EU decision-makers and by seeking to ensure that European R&D and innovation programs are best attuned to their interests. EARTO provide added-value services to their members to help them to improve their operational practices and business performance as well as to provide them with information and advice to help them make the best use of European R&D and innovation program funding opportunities.

International Association of Science Parks and Areas of Innovation (IASP)

<http://www.iasp.ws/home>

Spain

IASP is the worldwide network of science parks and areas of innovation. IASP connects the professionals managing science, technology and research parks (STPs) and other areas of innovation and provide services that drive growth and effectiveness for its members. IASP members enhance the competitiveness of companies and entrepreneurs of their cities and regions, and contribute to global economic development through innovation, entrepreneurship, and the transfer of knowledge and technology.

The European Network of Innovation Agencies (TAFTIE)

<http://www.taftie.org/>

Netherlands

Through TAFTIE a group of 28 organizations from 26 European countries has established an intense collaboration in the field of the implementation of national technology programs. The Association allows the national organizations to learn best practices from an analysis of how other members run their affairs. It also enables them to collaborate at a European level. We have a new ecology of industry in which corporate venturing; outsourcing of R&D to SMEs, specialized labs and universities has grown threefold. At the same time innovation increasingly requires close links with customers and suppliers, and with regulators who shape the market. To keep in pace with these developments and with phenomena like these open innovation systems the kind of cooperation TAFTIE offers to Members is even more important.

The Russian Technology Transfer Network (RTTN)

<http://transfer.nichost.ru/about?lang=eng>

Russia

The Russian Technology Transfer Network (RTTN) was founded in 2002. It is an association of 90 Russian Innovation Centres from 39 regions of Russia and CIS, specialized in technology transfer area. The RTTN is an innovation infrastructure tool, aimed at effective dissemination of technological information and partner search for implementation of innovation projects. RTTN's mission is assistance to development of innovation business and to commercialization of science-intensive technologies in Russia.

Franco-Russian technological network (RFR)

<http://rfr-net.org/?&lang=eng>

Russia

Franco-Russian technological network (RFR) — is a tool for establishing technological partnerships between France and Russia. RFR mission is to support Franco-Russian economic relations by initiating technological cooperation between French and Russian companies and research centres. RFR goal is to create a favourable environment for bilateral projects in scientific research (support of co-operation between national and private laboratories and companies) and technology transfer from laboratories to the industry and between industrial sectors.

Estonian Business Angels Network (ESTBAN)

<http://estban.ee/en>

Estonia

Estonian Business Angels Network, established in late 2012, is an umbrella organization for business angels and business angel groups seeking investment opportunities in Estonia and its neighbouring regions with an aim to grow the quantity and quality of local seed stage investments. At EstBAN, they are looking for startups that need between EUR 20,000 to EUR 500,000 in capital. EstBAN business angels are interested in companies that have a unique idea. They will look at any industry except real estate and gambling.

London Business Angels (LBA)

<http://www.lbangels.co.uk/>

England

London Business Angels (LBA) is one of Europe's leading Angel Investment Networks. LBA connects innovating fast growth technology companies to equity finance through their membership of experienced angel investors. They are a quality rather than quantity network, seeking out only the most innovative fast growth businesses for our discerning investors.

Singapore BANSEA - Business Angel Network SouthEast Asia

<http://bansea.org/>

Singapore

BANSEA was established in 2001 by a group of Singapore-based angel investors. BANSEA prefers to invest in first-of-a-kind new ideas, rather than incremental enhancements to common products and services. Is this a nice-to-have, or a need-to-have product or service. However, they approach highly complex, esoteric technologies with caution. The concept behind the technology must be proven and verifiable. Further, BANSEA avoids science projects that don't demonstrate a clear path to commercialization. Any breakthrough innovation must be accompanied by a strong business plan.

National Angel Capital organization (NACO)

<http://nacocanada.com/>

NACO incorporated as a non-profit in 2002 to promote and help create a vibrant Angel community in Canada by providing Angel investors with a secure environment to network and learn from their peers. NACO members are a diverse group of individual investors, Angel groups and other industry partners that provide support to early-stage companies. NACO works to connect our members and stakeholders through various means, but principally by hosting and attending industry events and workshops. NACO has been hosting events for Angel investors since 2001.

Finnish Business Angels Network (FiBAN)

<https://www.fiban.org/>

Finland

FiBAN is a Finnish, national, non-profit association of private investors that aims to improve the possibilities for private persons to invest in unlisted potential growth companies. The association's work is based on the activity by private investors and cooperates with networks supporting high-growth goals. The FiBAN network is today one of the largest and most active business angel networks in Europe with over 350 approved members and over 100 events held year 2013.

EBAN

<http://www.eban.org/>

EBAN is a non-profit association representing the interests of early stage investors across Europe. EBAN represents the early stage investment market in Europe, carries out research on the angel market and produces facts and trends, promotes the role and visibility of business angel networks and early stage funds in Europe and support the internationalisation of the angel and early stage industry and movement.

Angels Den Crowdfunding (AngelDEN)

<http://angels.angelsden.com/>

England

Since 2007, AngelDEN have been leading the way in making investment accessible for all with our monthly SpeedFunding events, Business Funding Clinics and Angel Clubs. Angels Den has a proven track record having risen over £16m in investment for startups. As well as that much needed cash, their angel investors may also offer expertise, support and useful contacts.

Appendix 3. Investor networks

Scandinavian investor networks

The Scandinavian countries offer a sort of alternative European investment choice. Three of the four countries in the region have their own currencies, setting them apart from the Euro zone, and there is a greater emphasis on natural resources and energy investment across the region.

Sarsia Seed AS, <http://www.sarsiaseed.com/?lang=en>

Sarsia Seed AS is a Norwegian Seed Capital Fund which invests in Norwegian early phase technology companies within the energy/cleantech and biotechnology/life science sectors. The Sarsia Seed Management team comes from a wide variety of backgrounds with a collective expertise which is extensive not only with respect to the various investment areas on which the fund focuses.

Investinor AS, <http://en.investinor.no/>

Investinor is an evergreen investment company funded by the Norwegian government and is investing in promising unlisted (private) companies aiming for international growth and expansion. Investinor manages NOK 4.2 billion (mEuro 525) and invests on the same terms and conditions as private investors, with a clear exit strategy for all investments

Nordic Development Fund, <http://www.ndf.fi/>

The Nordic Development Fund (NDF) is the joint development finance institution of the five Nordic countries. The objective of NDF's operations is to facilitate climate change investments in low-income countries.

Novo A/S, <http://www.novo.dk/>

Novo A/S, a private limited liability company fully owned by the Novo Nordisk Foundation, is the holding company in the Novo Group, and responsible for managing the Foundation's assets, which are currently valued at more than USD 40 billion. As an international investor Novo A/S works out of Copenhagen, San Francisco and London.

Leiv Eiriksson Nyskaping AS, <http://len.no/info.php?id=55>

Leiv Eiriksson Nyskaping AS is an integrated innovation network assisting start-up companies and budding entrepreneurs through consulting, courses and investor networks. Following companies and clusters from day one and helping them to grow into sustainable enterprises.

Dutch investor networks

The Netherlands and Belgium offers a favourable combination of assets to foreign investors. No wonder many global businesses of all sizes and industry sectors view the them as an ideal location

from which they can run their pan-European or local operations. The Dutch economy is noted for its stable industrial relations, a productive and well-educated workforce, and excellent IT connectivity and plays an important role as a European transportation hub.

Gimv, <http://gimv.com/en>

Gimv is a European investment company with over three decades of experience in private equity and venture capital. Gimv currently manages around 1.8 billion EUR (including third party funds) of investments in 72 portfolio companies, which jointly realise a turnover of more than EUR 6 billion and employ over 26,000 professionals.

Vesalius Biocapital Partners Sàrl, <http://vesaliusbiocapital.com/>

Vesalius Biocapital Partners invests in companies active in human health through venture capital funds raised since 2007. We have contributed to developing ten companies since inception, one of which was acquired through a trade sale.

LRM, <http://www.lrm.be/home/en>

LRM is the catalyst for the transition of Limburg's "production economy" towards an innovative and technological economy. With its uniquely intertwined offer of venture capital and infrastructure, LRM contributes to the transition of the economic DNA of Limburg.

CRP Santé, <http://crp-sante.lu/>

RP-Santé is the leading public organisation for basic, pre-clinical and clinical research in life sciences in Luxembourg. At the forefront of biomedical research, CRP-Santé aims at translating knowledge into clinical applications impacting on healthcare while shaping personalized medicine.

Forbion Capital Partners, <http://www.forbion.com/>

Forbion Capital Partners invests in Life Sciences and Biomedical Technology companies developing world-class drugs and technologies, with a clear focus on product development.

LSP, <http://lspvc.com/>

LSP is one of Europe's largest and most experienced healthcare investment firms. The combination of contributing to society and the prospect of associated financial returns is why investors entrust LSP to invest their capital.

BioGeneration Ventures B.V., <http://www.biogenerationventures.com/>

BioGeneration Ventures manages funds that are actively investing venture capital in the next generation of successful life sciences companies in The Netherlands, Belgium and Germany. We focus on high potential companies active in healthcare, therapeutics, medical devices, diagnostics and novel food applications.

Erasmus MC Biomedical Fund, <http://erasmusmcfund.nl/>

The Erasmus MC Biomedical Fund is an independent venture capital fund aiming to capitalize on new technological developments in the life sciences sector. The fund is a specialist fund, targeting companies that are developing commercially promising products and technologies.

Thuja Capital, <http://thujacapital.com/>

Thuja Capital is an independent venture capital firm specialized in investing in early-stage medical product companies in the Netherlands and Belgium. In addition we leverage our extensive network, advisory board and our own experience to help and turn good science into valuable innovative medical products.

Esperante Ltd, <http://www.esperanteventures.com/>

Esperante is a private limited Netherlands-based life sciences investments company incorporated in January 2004. Esperante brings significant expertise and a human healthcare industry contacts network gained through up to three decades of cross-functional management experience.

Israel investor networks

Top scores on global indexes of economic competitiveness, a striking concentration of innovative people, a culture that promotes experimentation and daring, and governmental eagerness to create supportive conditions for investors, combine to make Israel a leading site of investment far beyond what its small size and short history might suggest. An entrepreneurial powerhouse, Israel is a hotbed of pioneering technologies, profitable business opportunities, and high investment returns.

Israeli Advanced Technology Industries, <http://www.iati.co.il/>

The Israeli Advanced Technology Industries (IATI) is the largest umbrella organization representing the high tech and life science industries.

CBI, <http://cbi.co.il/>

Since its inception in 1998, the Company has been distinguished by its hands-on managerial involvement, unique investment strategy, long-term commitment, and deep understanding of the life sciences industry.

Appendix 4. Tools for licensing intellectual property

Profile	Comments
“Licensing” operations	The IP developed within a research organisation is “licensed” to a company. License is exclusive or not, with often limited coverage (market segments, countries, and time). Existing or planned initiatives in this area are often either supported by non-EU private groups or by national public groups without a European remit.
Projects funds	Investments are made not in a company but in projects. Overhead costs are initially low because it can be decided at a later stage whether to commercialise the IP through licensing or through a spin-out. The ownership of the IP developed within these projects needs to be contractually agreed upfront.
IP funds	Investments are made into individual IP assets (e.g. patents), which have a potential to be commercialised. Different investment strategies can be applied. One strategy consists in buying portfolios of existing but unused patents. Grouping individual patents into “patent families” can be valuable to potential buyers (or licensors) of the technology. Another strategy consists in selectively acquiring clusters of patents and building project teams around these technologies to further develop them to the point where they are attractive to commercial buyers.
Royalty funds	Fund buys the rights to the future royalty streams linked to a specific patent or pools of patents. This is applicable for patents that are already commercialised. By doing so, the fund increases the liquidity of the markets for patents.
IP line extension projects	Project financing is needed to develop further products on existing and already commercialised IP. The commercial use of existing IP-protected technologies can be extended with the development of tailored products for specific markets and customer profiles.
IP carve out projects	Spin-off or licensing-out of specific IP families that protect a potential new product from existing companies. Main driver is the lack of financing for second-line products which often bear higher potential than the first line but have more onerous product development. The cost of product development could then be addressed through TT financing.
Secondary use of IP	Most major innovative companies manage their IP portfolio actively, often maintaining IP portfolios which are not in the focus of the company. Also, stressed companies struggling for survival try to sell their IP when the underlying product development is at a too early stage but IP, know-how, skilled staff and results are in place. Acquiring the necessary IP and creating a new appropriate structure is a potential target of a TT transaction.

Appendix 5. Supported technology transfer projects in biotechnology (2008 – 2014)

University	Project	Grant amount	Project costs	Fond	Year
Estonian University of Life Sciences	Knowledge-Based Bio-Economy	264 985,94 €	264 985,94 €	ERDF	2008
Estonian University of Life Sciences	Knowledge-Based Bio-Economy	210 121,94 €	210 121,94 €	ERDF	2009
Estonian University of Life Sciences	Smart Bio-Economy	170 477,00 €	170 477,00 €	ERDF	2012
Estonian University of Life Sciences	Smart Bio-Economy	71 981,00 €	71 981,00 €	ERDF	2014
University of Tartu	University of Tartu Spinno Plus	639 116,49 €	639 116,49 €	ERDF	2008
University of Tartu	University of Tartu Spinno 2010	473 753,91 €	473 753,91 €	ERDF	2009
University of Tartu	University of Tartu Spinno 2012	466 893,00 €	466 893,00 €	ERDF	2011
University of Tartu	University of Spinno 2014	207 589,00 €	207 589,00 €	ERDF	2014
	KOKKU:	2 504 918,28 €	2 504 918,28 €		

Appendix 6. Time schedule for planned activities (2014-2016)

	2014				2015								2016															
	september	october	november	december	january	february	march	april	may	june	july	august	september	october	november	december	january	february	march	april	may	june	july	august	september	october	november	december
Action 1: Cooperation between companies, R&D institutions and business support structures																												
Setting up a group of representatives of the organisations (companies, R&D institutions and business support structures) aimed at developing biotechnology and technology transfer in Tartu																												
Start of regular meetings to share information (including new ideas and results from the science) and launch new initiatives for supporting technology transfer in biotechnology																												
Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu																												
Start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan)																												
Systematic attention on developing regular cooperation between technology transfer experts and universities, including involvement of experts in teaching technology transfer courses in the universities and making these courses more open for companies and inventors																												
Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project)																												
Action 2. Incubation services																												
Start of greater and more systematic involvement of foreign experts and investors in developing local companies: trainings, seminars, consultations																												
Study about developing incubation services in the region of Tartu 2015–2020																												
More attention on developing the network of mentors, deeper engagement of mentors																												
Increase of focus on internationalisation (e.g. study trips and roadshows in Europe, United States, Singapore, etc.)																												
Beginning of closer cooperation and twinning with successful international incubators.																												

	2014				2015												2016												
	september	october	november	december	january	february	march	april	may	june	july	august	september	october	november	december	january	february	march	april	may	june	july	august	september	october	november	december	
Action 3: Availability and utilisation of the pre-seed and seed funding																													
Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences																													
Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors																													
Support for local companies to participate in international recognized venture capital and business angels' events																													
Action 4: Awareness of technology transfer and incubation services																													
Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups, investors, etc.																													
Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology																													
Development of a modern website about the biotechnology sector in Tartu region																													
Stronger and more proactive involvement in international technology transfer networks and projects (fees, trades, com.materials)																													

Appendix 7. Budget for years 2014 – 2016

	2014				2015												2016												
	sept.	oct.	nov.	dec.	jan.	feb.	mar.	april	may	June	July	aug.	sept.	oct.	nov.	dec.	jan.	feb.	march	april	may	June	July	aug.	sept.	oct.	nov.	dec.	
Action 1: Cooperation between companies, R&D institutions and business support structures																													
Setting up a group of representatives of the organisations (e-mails, meetings)	150	150	150																										
Start of regular meetings (materials, coffe breaks)		150	150	150																									
Formation of a coordinated action plan to attract foreign biotech companies to the region of Tartu (composing action plan, meetings, workgroups)									12000																				
Start of coordinated joint operations to attract foreign companies to the region of Tartu (implementation of the action plan)								3000				5000																	
Systematic attention on developing regular cooperation between technology transfer experts and universities(preparation works, material printing, meetings)												1000	600	600	600	1000	600	600	600	1000	600	600	600	1000	600	1000	600	600	600
Formation of a wider Biotechnology Development Plan for the region of Tartu (expansion of the implementation plan drafted in the framework of the ETTBio project)															10000						15000							10000	
SUM	150	300	300	150	0	0	0	0	15000	0	0	0	16000	600	600	600	16000	600	600	600	16000	600	600	600	11000	600	600	600	600
Sum per year	900				32800												48400												
Action 2. Incubation services																													
Start of greater and more systematic involvement of foreign experts and investors in developing local companies: trainings, seminars, consultations	400	800	800	600																									
Study about developing incubation services in the region of Tartu 2015–2020	5000				5000										5000														
More attention on developing the network of mentors, deeper engagement of mentors	1000	500	400	600	1000																								
Increase of focus on internationalisation (e.g. study trips and roadshows in Europe, United States, Singapore, etc.)		3000				5000			10000		15000			6000		5000													
Beginning of closer cooperation and twinning with successful international incubators (visits, webinar platform rent, common marketing materials etc.)							2000	200	500		2000				600		2000	600	200		3000	600		600	6000	2500	3000	500	
SUM	6400	4300	1200	1200	6000	5000	2000	200	10500	0	17000	0	6000	5600	5000	0	2000	600	200	0	3000	600	0	600	6000	2500	3000	500	
Sum per year	13100				57300												19000												

	2014				2015												2016											
	sept.	oct.	nov.	dec.	jan	feb	mar	april	may	june	july	aug.	sept.	oct.	nov.	dec.	jan.	feb.	march	april	may	june	july	aug.	sept.	oct.	nov.	dec.
Action 3: Availability and utilisation of the pre-seed and seed funding																												
Stronger and more systematic attention on developing closer links and cooperation with business angels and venture capitalists focused on biotechnology and life sciences (fees, meetings, travelling, materials etc.)	1200	300	2500	300	2500	500	500	500	3500	300	300	300	600	500	4000													
Organisation of regular investor seminars in Tartu region to share knowledge for start-ups and to present them to investors (events, meetings, preparation courses, consultations)					4500			3000							5000			2000				1500				1500		
Support for local companies to participate in international recognized venture capital and business angels' events			1000					3000				1500			2000						1500			1500		2000		
SUM	1200				7000	500	500	6500	3500	300	300	300	2100	500	4000	###	0	0	2000	0	1500	0	1500	0	1500	1500	2000	0
Sum per year	1200				32500												10000											
Action 4: Awareness of technology transfer and incubation services																												
Regular production of short videos about companies, R&D institutions and business support structures involved in technology transfer in biotechnology for potential start-ups.					2000	2000		2000		2000	1500			6000		2000			2000				2000			2000		
Start of systematic efforts to gain more media attention to the issues of commercialisation, technology transfer and start-up companies in the field of biotechnology			2000			700	700			700		2000	1000			700			700				700			700		
Development of a modern website about the biotechnology sector in Tartu region				1500							1500			1000														
Stronger and more proactive involvement in international technology transfer networks and projects (fees, trades, com.materials)									1500	500	500					3000	2500	500	500	2500	500	500	500	2500	500	2500	500	
SUM	0	0	2000	0	3500	700	2000	700	3500	500	3200	3000	2000	0	7000	###	3000	5200	500	500	5200	500	500	3200	2500	500	5200	500
Sum per year	2000				27100												27300											
Total (per year)	17200				149700												104700											