BUSINESS
FINLAND

REPORT 2/2018

EVALUATION OF PRE-COMMERCIALISATION ACTIVITIES OF TEKES – TUTL AND INNOVATION SCOUT

EVALUATION REPORT

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BUSINESS
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ISSN 1797-7347
ISBN 978-952-457-636-9

Cover photo: N2
Graphic design: Maria Singh
Page layout: DTPage Oy

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FOREWORD

The traditional tasks of universities that are basic research and higher education, have served well in Finland. However, turning university research into competitive products and services has been an area worth improving. Tekes has had an important role in this especially in the form of "TUTL" funding, standing for "New knowledge and business from research ideas", operative since 2012. With this funding instrument, Tekes enables establishment of new business from research at universities and research institutes. At the same time, TUTL together with its more recent counterpart "Innovation Scout" has worked as an incentive for universities to add focus and build up competencies in research commercialisation and technology transfer.

The purpose of this study has been to analyse the results, relevance and efficiency of TUTL and Innovation Scout activities and to produce recommendations for the future. As a result, good analysis and solid recommendations were produced that have been thoroughly discussed within Business Finland, the successor organisation of Tekes.

This study was carried out by MDI Public Oy as the lead consultancy, together with 4Front Oy, Gaia Consulting Oy and Ramboll Management Consulting Oy. Tekes wishes to thank the writers for their thorough and systematic approach and is grateful to the steering group and all the others that have contributed to the study.

Helsinki, March 2018

Business Finland

1 BACKGROUND OF THE PROJECT

Tekes – the Finnish Funding Agency for Innovation has used various funding instruments to support the development of new businesses from public research. The TULI-programme (Tutkimuksesta liiketoimintaa, Creating Business from Research) was Tekes' targeted long-term effort aimed at creating business from public research. TULI started in 1993, reforming in 2002 to a programme, further renewing in 2007 and ending in 2012. More importantly, the programme aimed to induce development of competences and structures within recipient organizations and was a central instrument of Tekes to improve the effectiveness of research commercialisation.

Currently – and most notably – the funding instrument to support the development of research results into new businesses is TUTL ("Tutkimuksesta uutta tietoa ja liiketoimintaa", "New knowledge and business from research ideas"). TUTL is targeted at researchers and research teams in state research institutes, universities, universities of applied sciences, non-market based state owned companies and cities/municipalities. The broader goal of TUTL is to support the creation of new internationally competitive growth companies. TUTL-instrument started in 2012. By the end of 2017, Tekes has made 430 funding decisions granting 138 million euros for 380 separate projects.

To receive funding, which is 70% of the costs, TUTL applications need to provide clear answers to questions such as: How credible is the team and does it have commercial expertise? Is there a market need and how large is the commercial potential? What are the value chains? Is the solution scalable? Is there IPR to ensure business opportunities? From the budget, a project needs to allocate 30% (later 40%) to business development activities while the rest can be used for research. IPR needs to be in the hands of the recipient organization and a preliminary freedom-to-operate analysis needs to exist. Regarding the commercialisation route, several alternatives need to be in place instead of just one.

Additionally, since 2015, Tekes has run an "Innovation Scout" activity that aims to promote competence development regarding research commercialisation in research organizations.

Tekes has ordered an evaluation of TUTL and Innovation Scout as part of their strategic partnership. The evaluation was carried out by MDI Public, Gaia Consulting, Ramboll Management and 4Front. The results of the evaluation are presented in this report.

1.1 OBJECTIVES OF THE EVALUATION

Tekes support for research commercialisation has taken the diversified scene into account, and the funding for research organisations was focused e.g. on building competences and encouraging learning processes. This evaluation will look into how Tekes support has worked in and affected the commercialisation processes of research organisation and will specifically evaluate the instruments of TUTL and Innovation Scout.

The Evaluation research has aimed at answering the following research questions:

- Since the TULI-programme, what significant factors have affected commercialisation of research results in Finland and elsewhere?
- What are the recent research commercialisation practices in 3-5 relevant countries?
- How well have TUTL and Innovation Scout succeeded as enablers for research commercialisation in Finland.
- How relevant and challenging were the objectives of TUTL and Innovation Scout activities? How well did they respond to the findings and recommendations given in the evaluation of the preceding TULI-programme?
- To what extent have the objectives set for the activities been achieved? What are the most important results?
- What results were achieved that were not initially within TUTL or Innovation Scout objectives? What concrete outcomes from TUTL have been implemented in Finland?
- How well were the most important customer groups reached? How well did the programmes, their services and administration meet the needs of the participants?
- How efficient has TUTL activity been? Any possible bottlenecks?
- To what extent and in what ways has TUTL impacted the following:
  - Formation of new business (domestic and international) from public research, especially considering new companies, revenue, business deals, employment figures.
  - Formation of operating practices, networks, capacities and structures supporting research commercialisation within public research.
  - Formation of important knowledge, innovations and business opportunities

As a result of the evaluation, conclusions and recommendations have been formed to the following questions:

- How should research commercialisation activities be developed in the future at Finnish universities, research institutes and universities of applied sciences? What kind of funding and other services should this require?
- What kind of activities should be built by Tekes, alone or in collaboration with others, to support efficient formation of new business from public research?
- What should be the measures of innovation policy to support commercialisation of research results? What

should be an optimal investment ratio between basic research, applied research and activities aiming for commercialisation of public research (such as TUTL or Innovation Scout)?

The evaluation has been structured in accordance with the Tekes impact analysis model. The study was carried out through four work packages, that were: 1) Literature review of operating environment, 2) Results achieved, relevance and efficiency of TUTL and Innovation Scout activities, 3) Conclusions and 4) Reporting and final outcomes.

1.2 METHODS AND RESEARCH MATERIAL

The evaluation was carried out using several different research methods. These include:

Document analyses and literature reviews: Analysed material was TUTL- and Innovation Scout documents, recent research and the material that is available from Tekes' project monitoring system of TUTL and Innovation Scout-projects.

Thematic interviews for experts and TUTL/Innovation Scout project executives: Themes of the interviews were a) the development of the operational environment, b) the impacts of the activities, c) the effectiveness of Tekes activities in general and d) the future development of public RDI activities in commercialisation of research. The number of interviews conducted was 14.

Surveys: Using e-surveys (Webropol), data was collected about the success of the activities, implementation, results and impacts and the added value and significance of the Tekes instruments. Three surveys were executed:

- For TUTL-project contact persons in organizations/research groups that have received TUTL-funding. The questionnaire was conducted between 29.9.2017–13.9.2017. During this period, 144 answers were received which was 46% of all of potential respondents.
- For contact person in organizations/research groups that have applied, but have not received TUTL-funding. The questionnaire was conducted between 10.10.2017–17.10.2017. During this period, 55 answers were received which was 17% of all of potential respondents.
- For contact persons in organizations/research groups that have conducted Innovation Scout/KINO -projects. The questionnaire was conducted between 10.10.2017–17.10.2017. During this period, 16 answers were received which was 33% of all of potential respondents.

Case studies. The impact mechanisms that determine the outputs from RDI inputs are often complicated and difficult to observe. These mechanisms were investigated using case studies of the research institutions and funded projects. A more detailed understanding was formed about the commercialising process, the role and

importance of commercialisation and the role of TUTL and added value in different research organisations. Case studies were conducted through interviews and by analysing documents. The participants were VTT, University of Helsinki/Helsinki Innovation Services, Saimaa University of Applied Sciences and Tampere University of Technology. The case studies describe the existing processes, but only to the extent that is needed for setting the context for TUTL and IS evaluation.

International Benchmark analyses: Countries selected for the benchmark analysis were Canada, Norway and the United Kingdom. Information was gathered and analysed from these countries of different practices and instruments of promoting commercialisation of research results and research policies regarding the commercialisation of scientific research results.

Workshop: One workshop was organized to combine the findings of different work streams and generate final conclusions. The workshop (10.11.2017) was organized to validate the conclusions made in the research regarding the relevance, effectiveness and impacts of the evaluated activities and to finalize the recommendations made for Tekes, research organizations and to Finnish innovation system to better commercialize research results.

Statistical analyses: Descriptive statistical analysis of the financial data from Tekes and of survey results was conducted during the evaluation. In addition, statistical analysis was conducted to estimate the amount of new companies and IPR created in TUTL-projects in the future.

2 THE ENVIRONMENT FOR R&D COMMERCIALISATION IN FINLAND

Finland is a small open economy dependent on its competitiveness on the global market. Even if Finland still excels on a number of welfare and economic indicators, the ability of Finnish RDI environments to commercialize R&D products and services has been facing a number of challenges during the last years. The global recession around 2008–2009 hit Finland hard and economy has not recovered at the same pace as in some other countries. Many businesses have chosen not to invest heavily in innovation and the Finnish innovation environment has not generated enough new commercialized products and services to the global market. At the same time, the public RDI funding especially for Tekes has been reduced and Tekes has changed their funding for research-company cooperation so that less funding is available especially for large companies for their research cooperation.

The current global trends in business and industry environments evolve around digitalization and globalization of value networks that call for stronger, more agile and more open innovation networks, open and available knowledge and data, and new co-creation models. These trends heavily affect the more traditional industry areas, which for many years were the backbone of the Finnish industry structure (pulp and paper, heavy machinery and metals). The traditional industry sectors have been under massive structural changes and this has affected strongly the cooperation with research and commercialisation of the research results. In the interviews, it was specifically highlighted that the traditional licencing based commercialisation of research results has significantly dropped.

At the same time in Finland, a new type of start-up scene has emerged. While Finland used to be behind many other economies in indicators measuring entrepreneurship and start-up activities, today it offers a good setting to start-ups and growth-oriented businesses. Universities and start-up communities around them have had an important role in this development. In addition, the funding prospects of start-ups and growth businesses have improved considerably and the backbone of the Finnish industry is today shifting more towards SMEs (e.g. in terms of employment). However, the

scene is too domestic and there are currently not enough globally operating medium-sized Finnish companies. In addition, it was emphasized in the interviews that the start-up financing structure is far from perfect and there still is a clear gap in the seed phase financing for new start-ups.

The key to improving the innovation capacity is generally seen as the acquisition of new information and competence, utilisation of R&D networks and combining competences from multiple disciplines. Therefore, it is vital that research results are utilized in business and industry. Traditionally, large companies have created a significant proportion of Finland's research and development, they have led the development of RDI networks with SMEs and research organizations, and been the main commercialisation unit of innovations. Finland has excelled in industry-research collaboration and this strong tradition was emphasized in the interviews as one major strength of the Finnish system. Recent developments include, however, a shift in R&D activities from large companies to universities. The university and research institute sector has over the last years undergone major structural changes, driven by policy decisions, and the R&D commercialisation in research organizations is characterised by many challenges.

The Reform of the Universities Act 2010 and the *University of Applied Sciences' Reform 2014* changed the legal status of universities into private entities. This has given them more independence in designing and organizing their commercialisation activities and industry cooperation and has enabled them to attract private funding and make their own investments. The Comprehensive Reform of State Research Institutes and research Funding 2013 changed both the organisational and financial structure of research in Finland, e.g. by mergers and by turning the legal status of VTT Technical Research Centre of Finland (a major player in Finland in R&D commercialisation and in business cooperation) into a limited liability company. At the same time, the reform created new financial incentives for research partnerships on issues of high societal relevance. In addition to these reforms, the change in the Higher Education Institution Inventions Act 2007 gave universities the rights to inventions conceived within their domain and provided incentives for R&D commercialisation.

Due to these reforms, the number of universities and research organisations decreased through mergers and at the same time, the organisations strengthened their strategies.

The reforms and development during recent years has also evoked some criticism concerning the lack of a national view on the development of innovation capabilities. According to these views, there is a lack of alignment of priorities regarding research commercialisation between the university budget funding of the Ministry of Education and Culture, the sectoral ministries' coordination of sectoral research organisations, and the innovation funding distributed through Tekes under the Ministry of Economic Affairs and Employment. Many interviewees highlighted that there is still lack of clear incentives for universities for commercialisation of R&D results.

Another concern raised is that while Finland is an open economy, its research and innovation system remains quite domestic and lacks a systematic structure and processes to reach global networks and investors. This is reflected e.g. in international indicators measuring the quality of research, where Finland excels in many areas of science, but Finnish universities are ranked relatively low. However, the Finnish markets are restricted and both the clients and the investors are often international. Finding these contacts can be extremely challenging for individual universities.

Yet another characteristic of the Finnish R&D system is the importance of regional and local city level activities, where different public or public-private development organisations have had a significant role in facilitating the creation of innovation environments, in providing commercialisation services or in operating as innovation and experimentation platforms for companies and researchers. This is conceived both a strength and a challenge of the system, as it means that the scene becomes even more fragmented with regional and local variations in operational models and quality of services, and a concentration of knowhow to the Capital Region ecosystems.

This fragmentation also reflects on the strategic choices and the steering of the commercialisation at research organisations. Some organisations have positioned themselves more towards commercialisation and company cooperation, while others have chosen to concentrate less on these aspects. Some are already advanced with well-functioning processes, while others are only starting to build their competencies. The lack of incentives for commercialisation within the basic funding of universities remains a challenge. Many universities also lack commercialisation experts and researchers are reluctant to invest in commercialisation activities, as funding available for commercialisation is much less than funding available for basic research. The tools and processes used in commercialisation activities also vary a lot.

THE MAIN CHALLENGES OF THE ENVIRONMENT FOR R&D COMMERCIALISATION IN FINLAND

The main challenges of environment for the commercialisation of research have been the global recession, from which Finland has recovered slower than several other countries. Additionally, at the same time, there have been cuts in the R&D&I funding which has diminished the resources of Tekes, and affected commercialisation possibilities of research. Globally the business and industrial environments are developed around the digitalisation and globalisation of value networks, and they require stronger, more agile and open innovation networks, open and available data and new co-production models. For example, in Finland this has been a challenge for the procedures and structures of traditional industries, which has affected the commercialisation of research and the results of research (particularly regarding licencing) in these fields. Specific challenges of the national system regarding the commercialisation of research results are:

- Lack of national vision and political vision in commercialising innovations and developing abilities. There is lack of prioritising and a united view and regarding their relations as well as a common view between YO-funding of OKM, the research facilities of sector ministries and the Tekes innovation funding of TEM.
- The research environment is of a high standard and good quality, but in Finland there is a lack of systematic structure and working processes from university research to international networks.
- The national research and innovation system is too often only powered by domestic resources. Systematic structures and processes to gain international networks and investors are missing from Finland.
- There is little public funding for commercialising research results to pass the "Valley of Death" phase when compared to how much basic research is funded.
- The universities do not have their own ambitions or significant incentives for commercialisation and success does not affect the funding.
- The R&D&I system and funding are fragmented both regarding field and research organisations

TUTL and Innovation Scout have been critical regarding the Finnish innovation system because there is no other public funding method for commercialising the inventions of research organisations.

3 TUTL (NEW KNOWLEDGE AND BUSINESS FROM RESEARCH IDEAS) AND INNOVATION SCOUT –RELATED ACTIVITIES OF TEKES

3.1 ABOUT TUTL-INSTRUMENT

Tekes grants TUTL funding to research teams that have a research idea with a high potential for commercialisation. TUTL funding is aimed for preparing an idea for commercialisation and to promote development of an idea into a new business. TUTL funding is granted to state research institutes, universities, universities of applied sciences, non-profit state-owned companies and to cities/municipalities. Eventually, the goal of commercialisation in a TUTL project is firstly, to create a new business in a new start-up company, and secondly, to create new business for an already existing Finnish company.

Tekes provides funding up to 70% of the total cost of an eligible project. The TUTL project consists of two parts: commercialisation part and research part. At least 40% of the funding must be used on activities that promote commercialisation. In addition to this, within the research part of the project knowledge and know-how relevant to the utilization of the research idea is produced.

Two calls for TUTL applications are held each year. Tekes evaluates the applications by examining the novelty value and challenging nature of the technology or competence to be developed by the research project, the project's impacts on the development of major international business and society, and the role of existing businesses in the realisation and steering of the project and the utilisation of its results. Furthermore, Tekes evaluates project resources, competence level and international cooperation. The applicant must describe the expertise and previous references of the persons responsible for commercialisation. Usually, the project team's commercialisation skills present the greatest challenge.

During the project, several commercialisation opportunities and promising paths must be explored. The TUTL funds are used in projects to review the research idea from a commercialisation point of view and to get

proof of relevance. In addition, funds are used to get experimental confirmation of the idea and proof of concept, conduct innovation searches, make determination of customer value, carry out competitor analyses, make intellectual property rights analyses, implement funding and business model investigations and carry out commercialisation and entrepreneurship training. Furthermore, funds can be used for applied research, targeted at predefined market potential.

TUTL instrument has been preceded by other Tekes funding services for commercialisation. During 2003–2005, in a "Kauppi" experiment that was meant for commercialising research results, experts focused deeply on the utilisation and commercialisation of the results of extensive research by universities, colleges and research institutes. After this, during 2006–2008 the ISO POC was used. The most essential predecessor of TUTL funding method was TULI funding, which started in 1993. However, during the first years the funding was not systematic as the funding was granted to individual local projects. The first actual Tuli-programme was based on purchasing services from eight technology centres, and there was a strong local perspective in the programme. The second TULI programme was more strongly aimed at universities and colleges and introduced the proof-of-concept approach: testing the concept in the early stages of research. Additionally, as a method to improve their own development research there has been "Innovaatiokyvykkyyksien kehittäminen – IKK" (2011–2012) and "YO-TULI" for universities of applied sciences (included in projects) in the year 2011 and KINO funding, the equivalent of Innovation Scout, in the years 2015–2016.

3.2 ABOUT INNOVATION SCOUT

Innovation Scout funding is granted to research organisations to build capacities for research-driven business activities. Funding is directed to organisations, not to individual research teams. Funding is used for economic activities of research organisations to disseminate new knowledge and know-how created in research to society and business life.

Tekes evaluates the projects based on how well they support the applicant to transform their research results to business. Tekes funds are used to build capacity and tools to increase innovation and high-growth entrepreneurship at international level in higher education institutions and research institutes. This includes, e.g., the creation of contract models for the effective and flexible transfer of IPR from research organisations to companies, developing new operating models and working methods in co-operation with international partners, creation of tools to find and evaluate new research ideas for commercialisation, creating tools for project evaluation models, building a culture of disseminating research results and know-how to the society and the business world, and strengthening the networks between research organisations and businesses to enhance innovation activity. Funds are also used to develop international and

national cooperation models between actors to enhance economic activity, raise awareness and clarify roles of different actors.

The long-term objective of Innovation Scout is to increase commercialisation and innovation capacities of research organisations at organisational level. Tekes funding covers typically 40% of the project's total eligible costs.

3.3 REVIEW OF FUNDED PROJECTS

TUTL FUNDING

TUTL funding has been granted since 2012. According to the funding statistics, the cumulative status of the TUTL funding at the end of 2017 is the following:

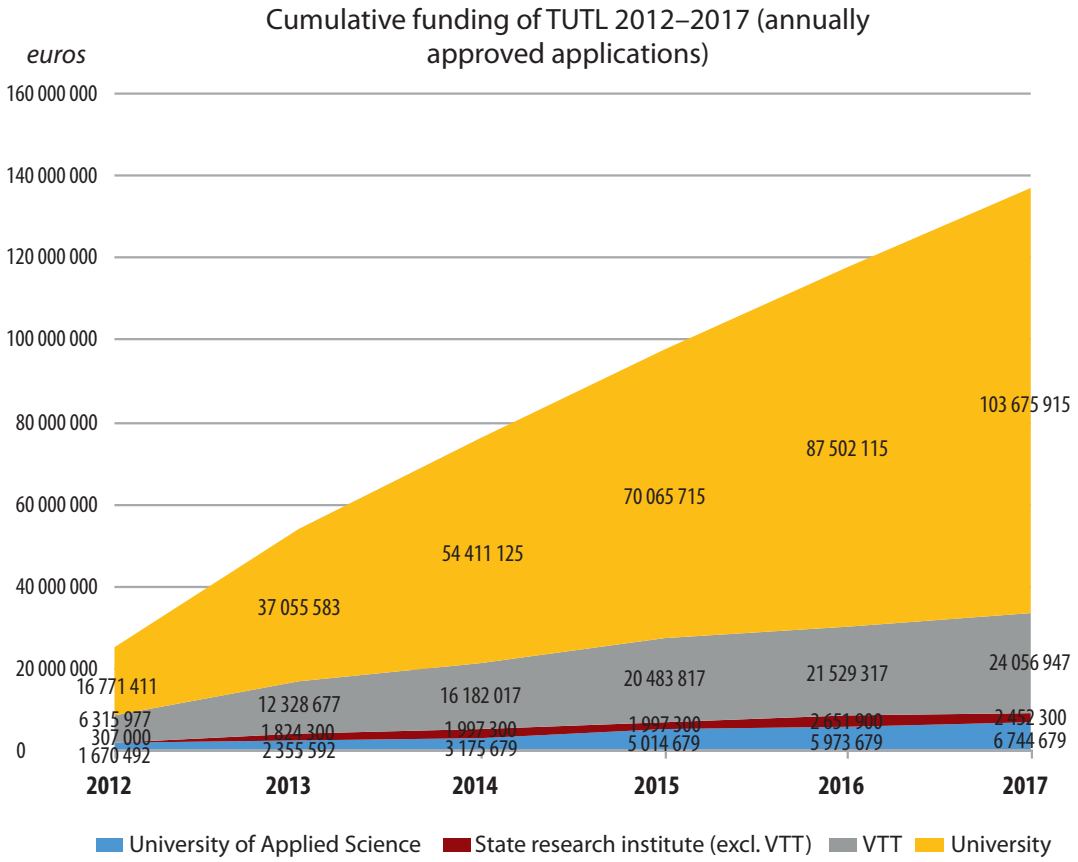
- Applications: 1070
- Applied funding: 360,4 M€
- Accepted applications: 472 (44%)
- Total granted funding: 137.5 M€ (2013–2017)
  - Universities/colleges: 103.7 M€
  - VTT: 24 MEUR
  - Universities of applied sciences: 6.7 M€
  - State research institutes (excluding VTT): 2.5 M€
- Organisation applicants: 53
- Applicants that have received funding: 32 organisations (60%)

Since 2012, the total funding has been 138 M€, of which universities and colleges have received a significant proportion. When measured by amount of funding, the most significant organisations have been VTT Technical Research Centre of Finland Ltd, University of Helsinki and Helsinki Innovation Service, Aalto University and Lappeenranta University of Technology as well as University of Jyväskylä, which have all received over 10 M€ of TUTL funding (a total of half of the granted funding). Based on the received funding, VTT has been the most significant single organisation.

Regarding TUTL funding, in addition to VTT also large universities have been the most successful in applying for funding and have received the most funding quantitatively. For example, 50% of the applications and fund applications have been successful. Instead, universities of applied sciences have applied for funding but have not been successful. In universities of applied sciences, the processes of commercialisation are not as ready and in order as in universities, which seems to influence the matter. The high pass rate of Saimaa University of Applied Science is an exception when compared to other universities of applied sciences. This has been influenced by the fact that Saimaa University of Applied Science has been working closely with Lappeenranta University of Technology (LUT) as well as the fact that they have benefitted from European Regional Development funding (ERDF).

The annual TUTL funding has decreased since 2013. The decrease in the funding (in 2016 funding is 60% of the funds available in 2012) is a significant change. The number of applications approved for funding has also decreased, while the average amount of funding per pro-

FIGURE 1. The cumulative development in the years 2012–2017 itemised by types of organisation.



ject has increased slightly. The duration of the projects has also shortened compared to the first years of the funding instrument available.

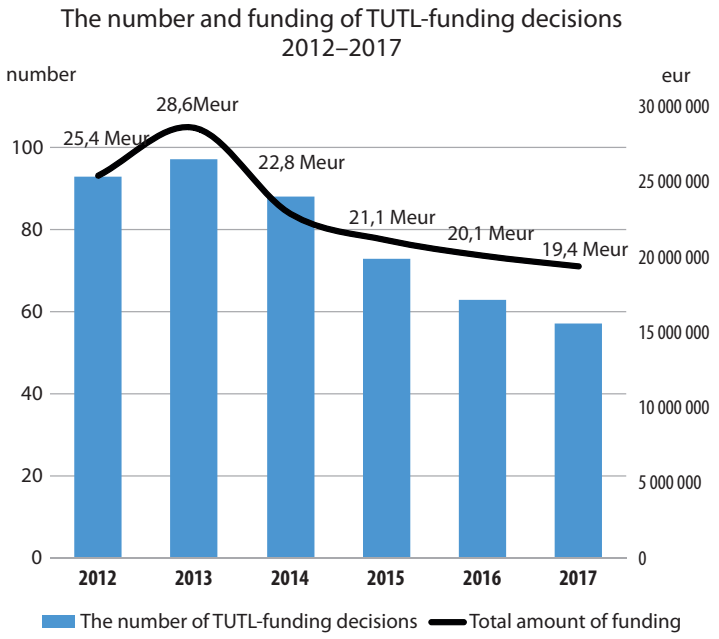
The number of applications has decreased in line with the reduced funding available. Thus, the share of the successful applications has remained stable over the course. Significant share of the decrease in the total number of applications can be explained by the decrease in the applications submitted by VTT. The reason for this change can be explained by the cumulated needs within VTT to acquire funding for commercialisation purposes by the time TUTL was implemented, resulting to high number of applications during the first years of TUTL. The number of applications decreased over the years as the projects in the pipeline had already received funding. Regarding some of the organisations, the number of applications for TUTL has increased.

There does not seem to be a learning curve regarding the success of the applications of different organisations in general. It cannot be said that they have learned from a previous, failed attempt to apply for TUTL funding. Annually at least 38% of the applications have been successful and in the best years more than half of the applications have been approved for funding.

Several organisations have not been able to receive TUTL funding despite many attempts. These include especially universities of applied sciences and individual research institutes.

As for disciplines, technical and electronic fields as well as bio and chemistry have received the most funding. They have received over 50% of TUTL funding. The medical field and ICT-related themes have received a significant proportion of TUTL funding.

FIGURE 2.
Annual TUTL funding decisions and the average size and duration of TUTL projects annually.



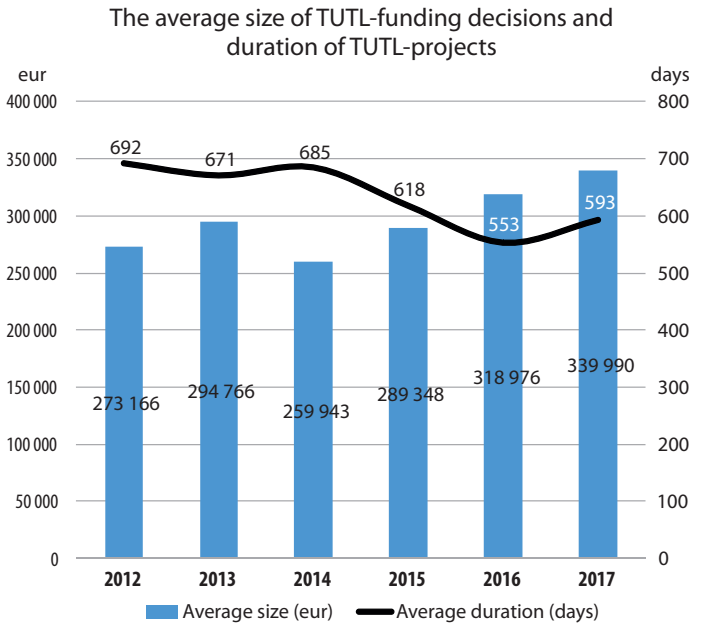
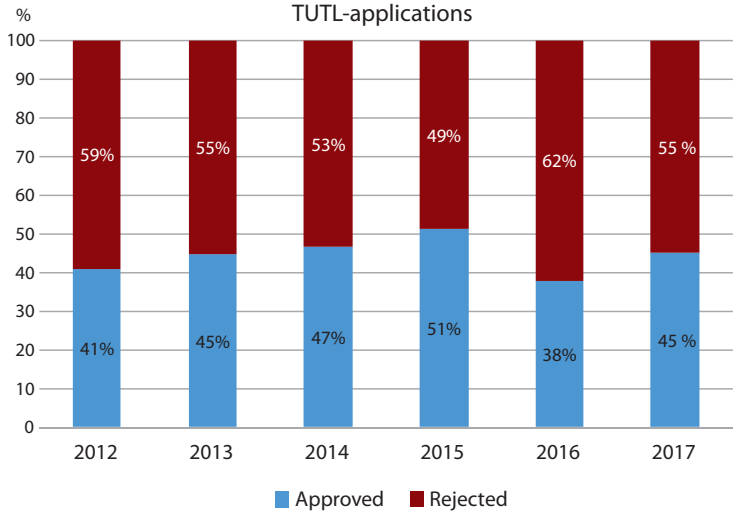


FIGURE 3.
The approval rate of applications and the funding applied and granted annually.



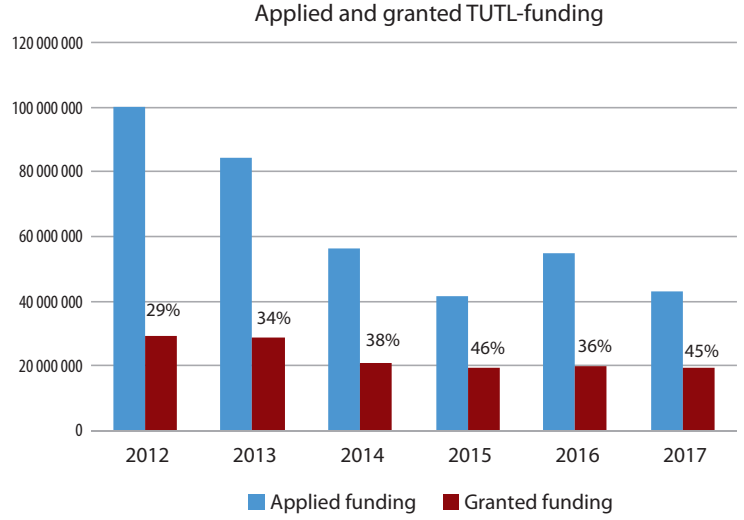
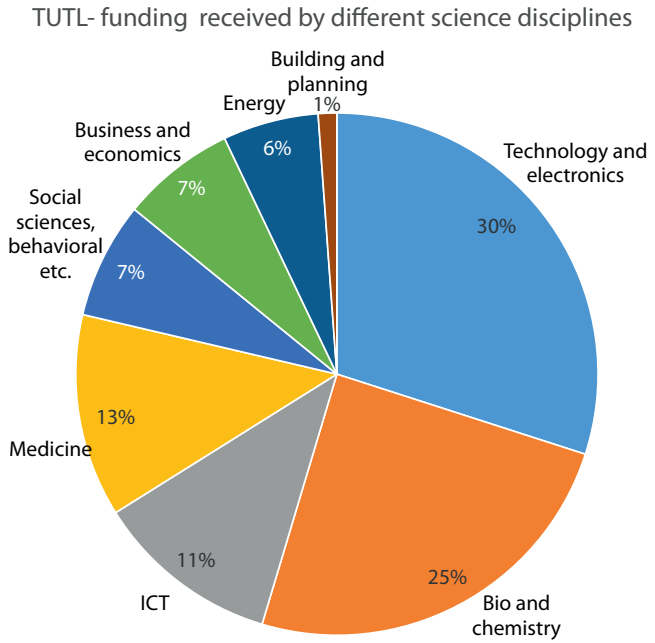


FIGURE 4. TUTL funding received by science disciplines.



KINO AND INNOVATION SCOUT FUNDING

A total of 4 171 050 euros of Kino funding and a total of 3 016 700 of Innovation Scout funding has been granted after the year 2015, summing up to over 7M€ in total. Universities and colleges have benefitted from the funding the most, having received more than 75% of the funding the two instruments: universities have received almost 60% of all KINO funding and almost 50% of Innovation Scout funding. There has been a total of 19 Kino projects and 22 Innovation Scout projects.

It should be noted regarding Kino funding that the applied funding for Universities of Applied Sciences is significantly lower than for Universities and State Research Institutes. More than two thirds of the funding Universities and State research institutes applied for was also received. Regarding Innovation Scout funding, two applications were rejected in 2016.

FIGURE 5.
Kino and Innovation Scout funding by types of organisation.

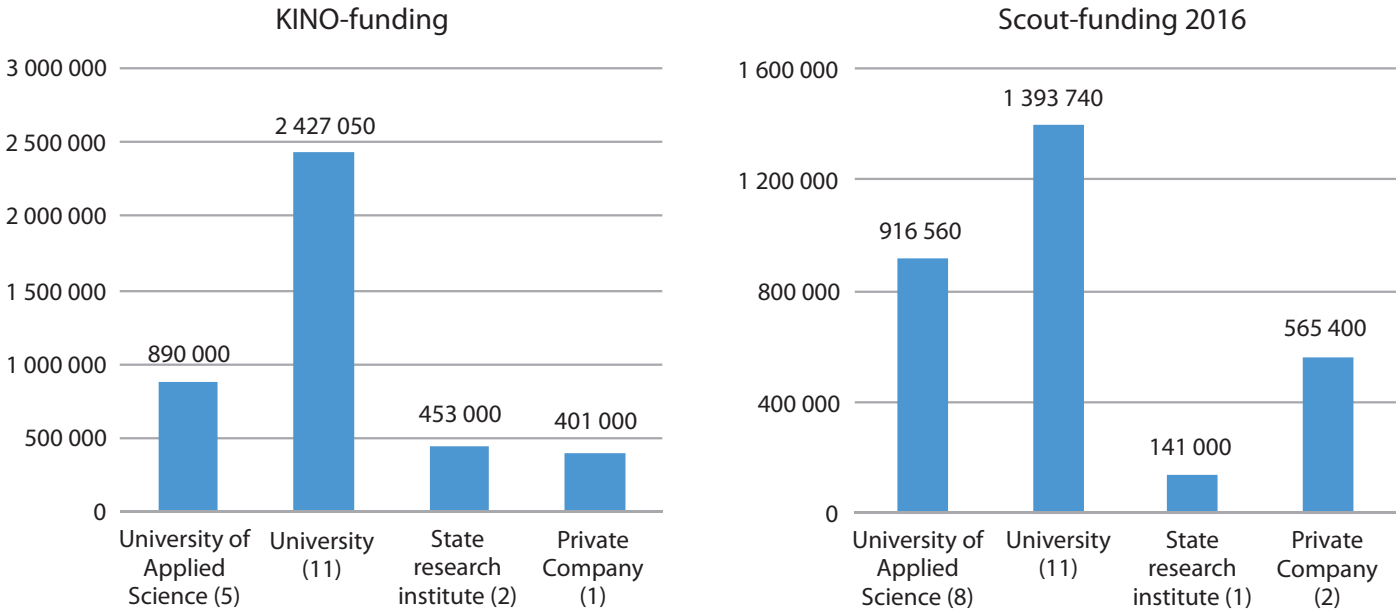
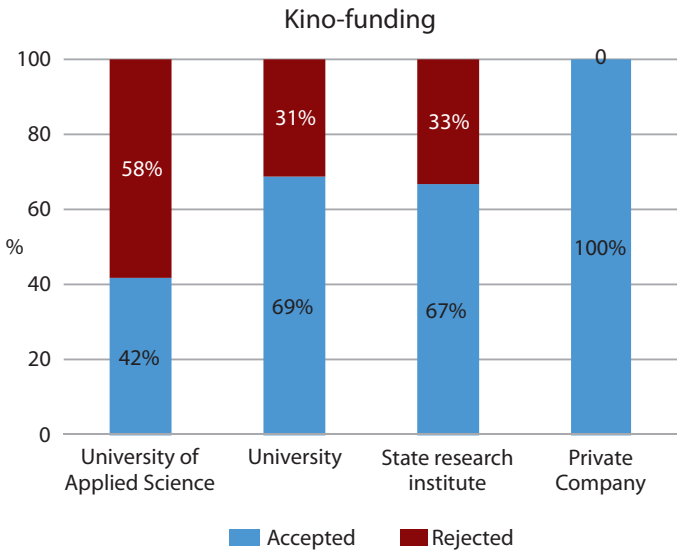


FIGURE 6.
The approved/rejected rates of Kino funding by types of organisation.



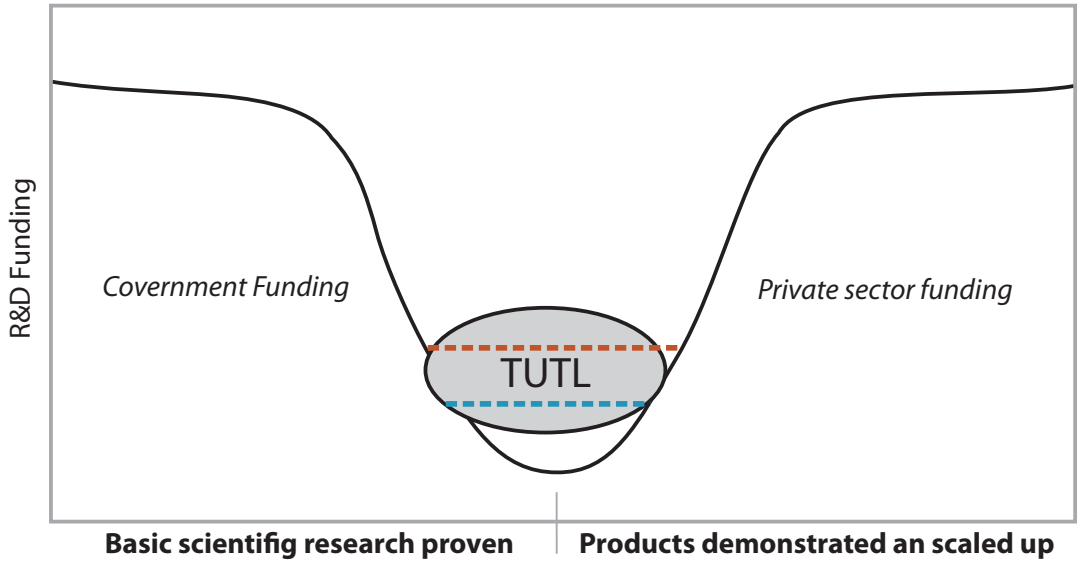
4 RELEVANCE OF TUTL AND INNOVATION SCOUT ACTIVITIES

The TUTL instrument as well as Innovation scout have hit a critical spot in activating and supporting the commercialisation of research in research organisations. There would not have been any other funding for many projects in the form that they were realised by TUTL funding. There has been a clear need for activating researcher organizations and offering them incentives and means for developing commercialisation. In general, there has been a demand and need for TUTL and Innovation Scout. TUTL and Innovation Scout funding is justified because of the lack of market in financing research. Different industries and research institutes/universities are not investing enough in commercialisation, in relation to the benefits and returns that are gained by the society from TUTL. There is no other public (or private) funding for preparing commercialisation or passing "the Valley of Death".

TUTL has acted successfully as an interpreter between the supply and demand in research commercialisation. Through TUTL, the surveying of the most important preforms to be developed, has been successful. Further, TUTL has been an important factor in bringing forth potential research preforms.

TUTL and Innovation Scout fill a clear gap in the funding of the commercialisation of research results, which was their purpose. However, they cannot, and it is not their purpose to solve for example the "big" challenges brought up by the OECD evaluation report (2017). The

FIGURE 7. The position of TUTL funding in relation to scientific research, product development and the initial "Valley of Death" phase.



challenges are related to improving management and effectiveness, developing strategic partnerships between the public and the private sectors, developing co-operation between SME's and larger companies in R&D, increasing the funding of research and innovation, advancing globalisation and prioritising the development of radical innovations in order to develop products and services of added value. The challenges require extensive actions regarding the innovation system.

TUTL and Innovation Scout are doing strategically correct things, but regarding their effectiveness, it needs to be asked, if they are too much focused on research (preforms). One of the most important conclusions of the TULI-programmes evaluation[1] (2012) was that a change is required in "trying to push research-based ideas to markets, towards a system, that integrates commercialisation into research and is steered by the needs of industry and end-users". According to the objectives and funding conditions of TUTL, the needs of customers and market demands are poorly connected to TUTL.

Regarding TUTL, the pathways used in commercialisation require clarification. It is unclear to research groups what and how the funding is aiming for commercialisation (spin-offs, knowledge transfer, and other paths of commercialisation). There is a long way from preparation to new business. There has not been enough modelling regarding the paths, and they do not have an intermediate objective or indicators. In this aspect, the steering from Tekes has not been sufficient.

[1] Path to creating business form research. Evaluation of TULI-programmes. Report 2/2013. Tekes

5 SUCCESS OF THE IMPLEMENTATION CONCEPT

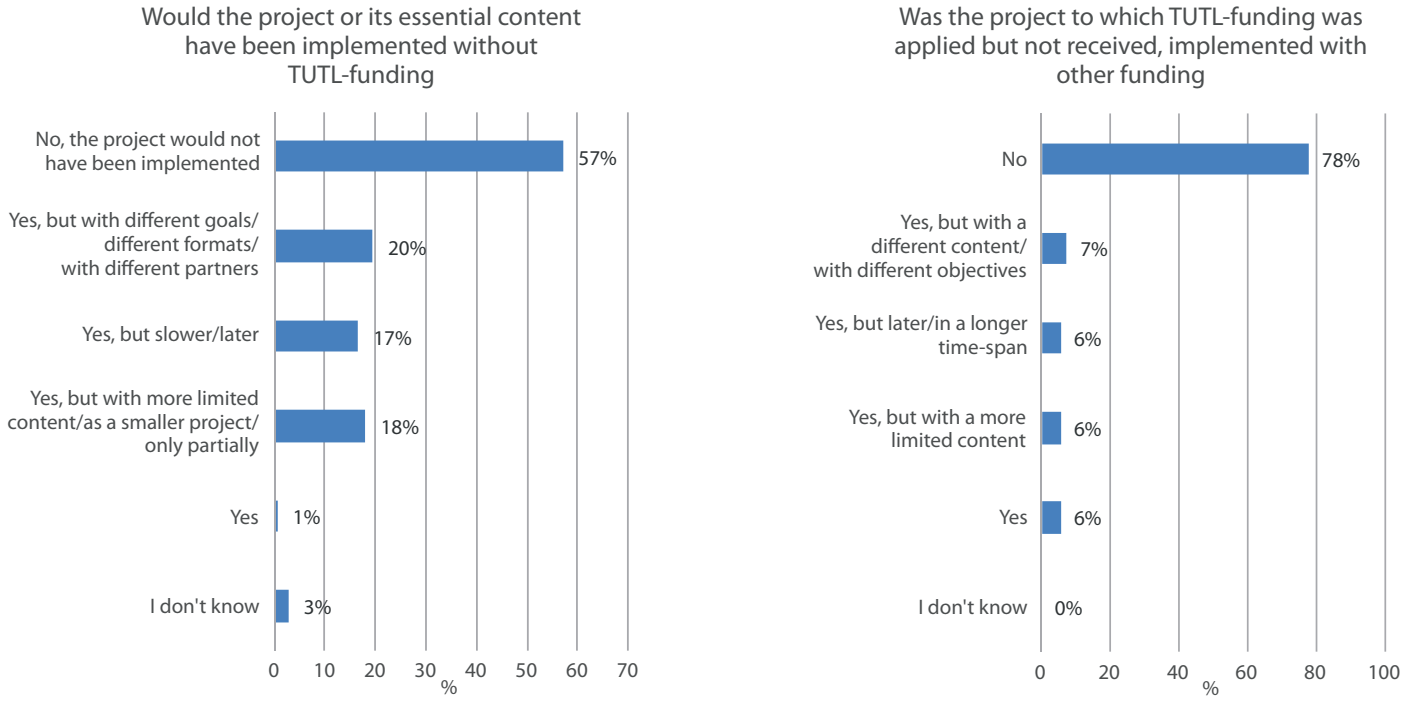
Essential in the success of TUTL and Innovation Scout is how the instruments have reached the most important client groups and how well the instrument filled the needs of its target groups. In the evaluation, attention has been paid on how the methods, focal points and operating methods have met the challenges of the operating environment and how they have reflected the client needs of research organisations.

TUTL funding has fairly successfully reached the target group that have created most added value with the funding. The "leaking effect" of the funding has also been small. The funding has made it possible to advance the commercialisation of such ideas that otherwise could not have been commercialised as well without the TUTL instrument. According to the project survey of the evaluation, a great deal more than half (the evaluation's survey for project implementers 57%) of the projects would not have been realised without TUTL funding. The rest of the projects would not have been realised with such a fast schedule and/or with such ambitious goals and/or with as broad contents.

The operating model was rather successful in choosing the applicants from the projects and organisations (VTT, Aalto, University of Helsinki) with the best chances for success. In the beginning, the funding reached mostly projects that were not mature enough for commercialisation. The operating model has successfully been developed so that the projects are better evaluated in the applicant organisations and in Tekes, and the most potential TUTL applications are selected more carefully. There are less projects, but they have been more justified, and the implementers have been more committed. Still, one of the problems with TUTL is that there are too many projects that are not ready and mature for commercialisation. There has not been enough time to test the potential for commercialisation, and the maturity is weak, which has led to resources being wasted on "immature" ideas.

There are several organisations that have not received funding from TUTL despite several attempts (among others a university of applied sciences). One important question is how Tekes and TUTL could better reach the potential projects and ideas of these organisations. At least, increasing the number of applications and enhancing the quality of applications in these organizations, would be important. An individual TUTL project

FIGURE 8.
The significance of TUTL funding for the realisation of TUTL projects, and the development of TUTL application ideas that have not received TUTL-funding (Surveys of the evaluation, autumn 2017).

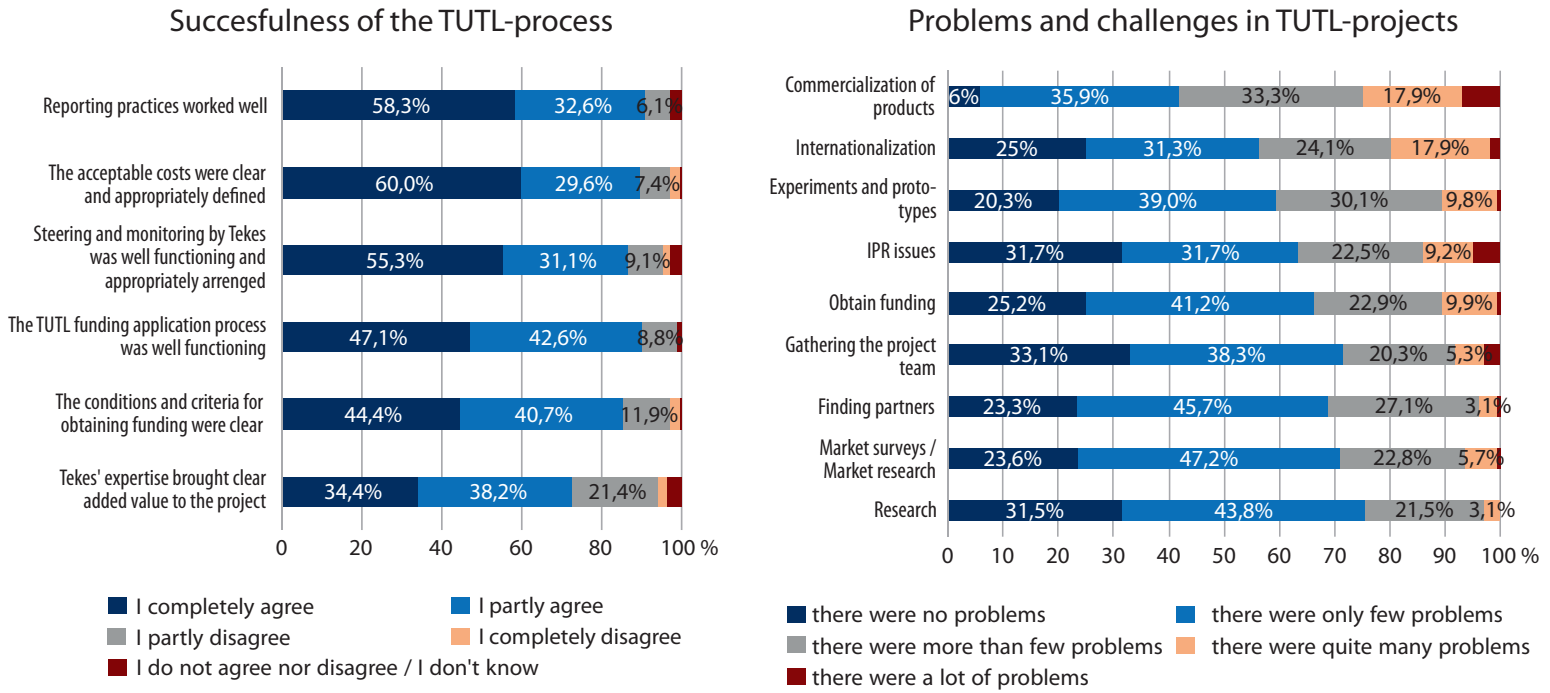


seems to have an important effect on the learning of commercialisation and the culture of commercialisation in organisations. For example, in universities of applied sciences, commercialisation of research could be developed more widely using TUTL and TUTL could have wider effects this way.

As a whole, the TUTL process has been carried out successfully and effectively. For example, 47% of the respondents of the implementers' survey have been extremely pleased and 43% somewhat pleased in the effectiveness of the TUTL process. Administratively the TUTL process has worked well in all parts of the process. For example, the reporting practices, the clarity of the acceptable costs, steering, and monitoring of Tekes have worked well. Especially during the application process, sparring from Tekes has been useful and valuable. Additionally, the application process has been clear. However, the slowness of the process has been a challenge for the needs of some fields (e.g. ICT), which require the process to be faster and continuous. This is highlighted in fields where there is a need to start projects quickly because the fields evolve rapidly.

The method of implementing TUTL and the projects of TUTL have made the preparation of commercialisation

FIGURE 9.
The successfulness of the TUTL process and the challenging and effective parts of TUTL projects (Surveys of the evaluation, autumn 2017).

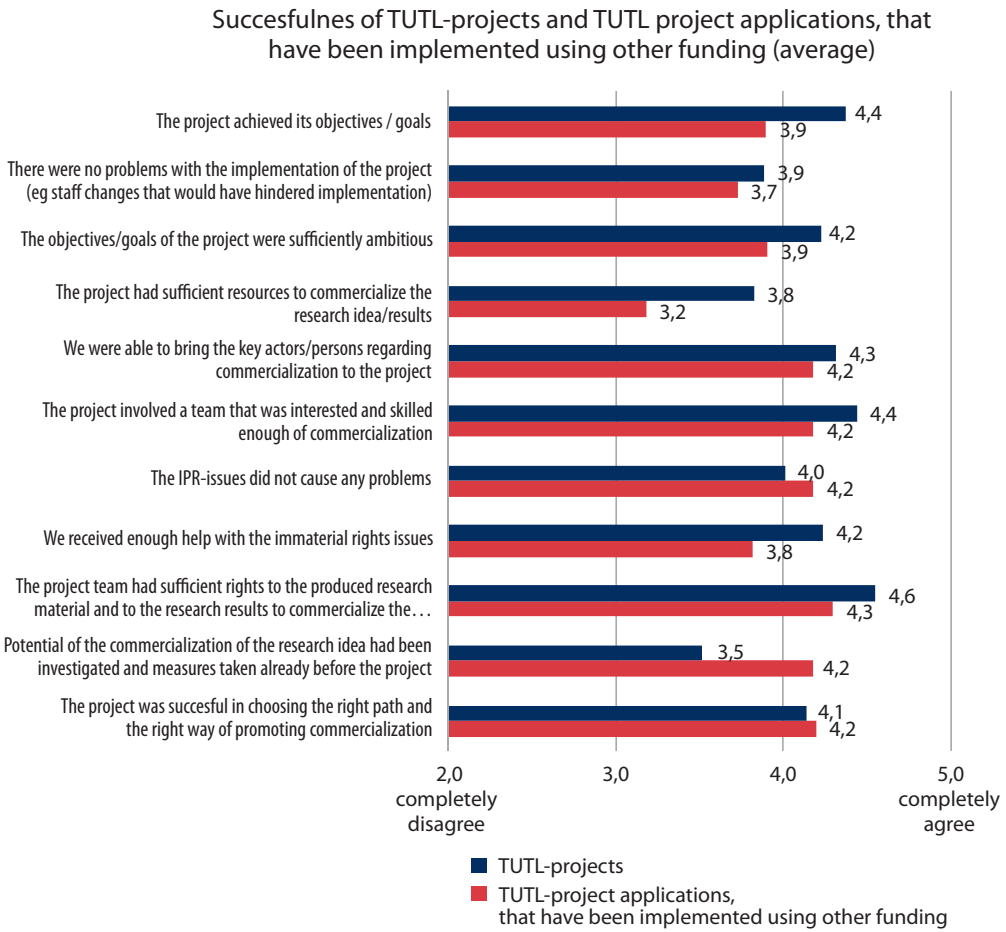


possible according to the objectives set. TUTL projects have been at their best as development platforms for ideas and in producing information about commercialisation. There are more challenges in phases closer to actual commercialisation. The most challenges in the implementation of TUTL projects have been in IPR matters (the unclear IPR-issues with universities vs researches and the transfer of IPR from research projects to companies), the trials and globalising of prototypes as well as (at final stages of projects) supporting the actual commercialisation of products and technologies.

TUTL instrument has been more effectively implemented and succeeded better in the commercialisation attempts than commercialisation projects implemented with other funding. The preform stages of projects that did not receive TUTL funding, but which were realised with other funding, have contained more challenges than TUTL projects, and these projects have been less capable than TUTL projects in supporting commercialisation.

TUTL has also been more efficient and direct as an instrument supporting commercialisation when compared to TULI, and it has improved many weaknesses and development needs of TULI (cf. TULI evaluation). The added

FIGURE 10. Successfulness of TUTL projects and applications that were realised with other funding in different areas ("I don't know" answers not taken into account) (Surveys of the evaluation, autumn 2017).



value of TULI projects turned out to be too small as they were a small-scale learning process focused on creating knowledge and surveying commercialisation ideas. The volume of funding has been increased in TUTL in individual projects, and TUTL has aimed for more ambitious results in the commercialisation process (new start-ups and new business in existing companies). Additionally, TUTL funding goes directly to Universities, Universities of Applied Sciences and research institutes whereas in TULI the resources were used on external experts/consultants working outside research organizations. TUTL has not been operational very long, but it seems that it is much more cost-effective than TULI as the objectives are commercial results (the number/funding of potential start-ups and growth companies). The reason for better cost-efficiency is the renewing of accepting criteria and the changes in focusing the funding on more selected targets in larger contributions.

Only a few TUTL-project have included preparatory work regarding the commercial potential of the invention before the actual TUTL-project. This has generally had a negative effect on the success of the commercialisation process. In addition, there are only few projects where investors and companies potentially interested in the commercialisation of the invention have been involved in the project. In the commercialisation, not very many experts outside the TUTL project (external consults, commercialisation actors and so forth) were utilised. The project personnel have usually had the main responsibility of commercialisation. Utilising experts from outside the project has been found to be useful in many projects in which they were used. However, the significance of outsiders has not been recognised by project teams and project implementers.

CASE HELSINKI INNOVATION SERVICES AS AN EXAMPLE OF WELL-FUNCTIONING AND EFFECTIVE COMMERCIALISATION PROCESS

Helsinki Innovation Services (HIS) of the University of Helsinki has developed a process for the commercialisation of research results using TUTL, which features a step-by-step progress in co-operation with Tekes. Innovation Scout projects have been an important factor in the creation of this process. The process starts when a research group in the University of Helsinki approaches HIS and completes an invention disclosure (about 100 per year). After this, HIS evaluates the commercial potential of the invention. In case commercial potential exists, HIS decides whether the related rights of the invention belong to the researcher or to the University. If the University owns the rights to the invention, HIS begins to promote it.

At the next stage, if possible, the invention will be protected by preparing a patent application, which will be done in collaboration with HIS and the research team. At the third stage, Tekes TUTL funding is used to increase the value of the invention and to refine and adjust it to meet market demands. HIS works as a commercial consultant in the TUTL project and is responsible for the commercialisation part. HIS is particularly important in finding the right partners and especially in gathering the right team for the commercialisation.

The next stage is entering the market, which results from licencing to a business partner or from a new spin-out company. If commercialisation is done through licencing, the compensation offered to the licence provider (the University) is determined in a separate licence agreement. In case of spin-outs, the project results are taken to CAB in UH (Commercial Association Board) for evaluation. The board evaluates, which results are suitable for spin-offs. If the research result gets CAB approval, the University of Helsinki funds will be used to grant capital loan to further commercialize the idea and Tekes funds will also be applied. ■

The scientific fields are very different, and the timetables of commercialisation and investment needs differ in these fields. In the current state, Tekes handles projects without taking the special characteristics of disciplines into account. However, there are clear time-related differences in developing technologies and commercialisation in different fields. For example, the development and commercialisation processes in the ICT field are often very short and fast whereas in medicine the progress from product development and testing to commercialisation takes years. The differences between disciplines should be noted better in TUTL, which means that there should be more flexibility and more thorough observing of these differences.

The ones that have used TUTL funding have very satisfied with the funding. On the other hand, there are doubts whether TUTL has enough steering effect to the commercialisation. In other words, are there enough built-in

incentives and obligations for commercialisation (e.g. a minimum of 40% of the expenses for commercialisation). Furthermore, there are not enough steering opportunities for commercialisation processes, because there are no clear and systematic tracking systems and indicators for measuring how well objectives are achieved.

INNOVATION SCOUT

Innovation Scout has largely worked as intended. In the organisations where it was used, Innovation Scout has increased understanding and knowledge about commercialisation and helped conceptualise new modes of operation. It has had an important role in developing commercialisation processes and internal modes of operation.

The added value of Innovation Scout has varied in the organisations that utilised it. In Universities of Applied Sciences, the commercialisation processes have been more incomplete than in Universities, and they have benefitted from Innovation Scout relatively more than Universities especially in the development of modes of operation, operation models and processes that support commercialisation. Universities have benefitted more regarding commitment, creating new IPR solutions as well as increased numbers of commercialisation preforms.

Together the Innovation Scout and TUTL projects have supported cultural change and the reinforcing of the commercialising culture quite well. Even though there have been changes in organisations because of Innovation Scout, more significant cultural change does not happen overnight. Factors influencing this include the attitudes of the management and staff of Universities, prioritising tasks and the steering system of Universities. Furthermore, the criteria of OKM and performance management do not support commercialisation objectives enough in Universities. More effective steering has been noted in the level of national objectives[2], but significant changes have not become concrete enough in performance management.

Reinforcing the commercial way of thinking requires time and additional work as well as implanting the modes of operation created by Innovation Scout as parts of the basic operation of Universities and Colleges. With Innovation Scout, many organisations have been able to create structures for commercialisation and to start the processes. The challenge is that the modes of operation have not become a part of the systematic and permanent way of functioning. There is a threat that the influences of Innovation Scout do not become permanent if the implanting process is not completed. At the moment, the influences of Scout as well as the good and efficient practices do not have long-lasting effect and seem to be organisation-specific.

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[2] Amongst others, Korkeakoulu- ja tiedepolitiikkaa koskevat linjaukset - Osaamisen ja koulutuksen kärkihankkeet: tietopohjan valmistelu työ- ja elinkeinoministeriön kanssa korkeakoulujen vaikuttavuuden seurantaan huomioiden kaupallistaminen (Opetus- ja kulttuuriministeriön tulossuunnitelma 2017), Sipilän hallituksen kärkihanke ”Vahvistetaan korkeakoulujen ja elinkeinoelämän yhteistyötä innovaatioiden kaupallistamiseksi”.

To establish and further develop the structure and processes created by the KINO/Innovation Scout projects, many projects need further funding or other support. There is a lack of public instruments in this with which to make the individual changes permanent and continuous after the operations of Innovation Scout. Additionally, it would be useful to have built-in incentives and obligations for co-operation in the instrument, which would enhance the sharing of information.

To the expected added value Innovation Scout can create, it has been a challenge that research organisations are fundamentally in different positions regarding how well commercialisation can be enhanced. In addition, Innovation Scout has brought funding for operations that would have been funded in any case. It needs to be considered, if the Universities should have a larger role in funding and implanting the needed changes in the future, especially if these changes are regarded positive and desirable in Universities.

6 RESULTS AND IMPACTS OF TUTL

TUTL funding is used for precommercialisation activities, which are related to preparing inventions for commercialisation and the protection of IP, clarifying and planning the paths of commercialisation as well as surveying partners for commercialisation. The aim of the preparations is to create new business primarily in the form of new spin-off companies and secondarily in the form of new business in an existing Finnish company.

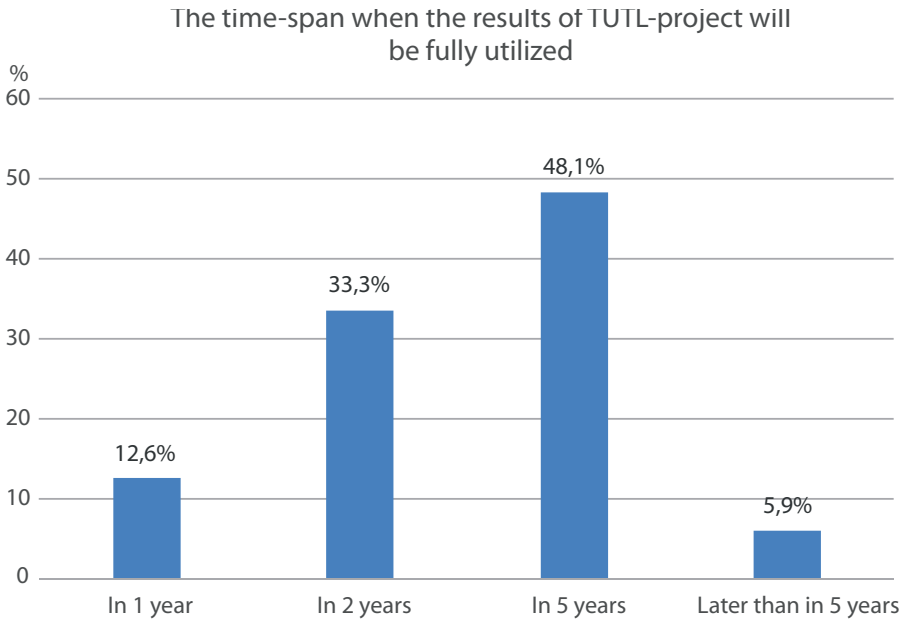
The TUTL instrument has been active few years now and IS/KINO only since the year 2015. The effects are formed in the long term, and the final results and influences can only be evaluated after many years from the current moment. There are only few projects within the TUTL-instrument that have ended long enough ago so that the final results and impacts can be observed. In the case of most projects (that have ended recently or are on-going), the final results of commercialisation process will be observable after many years from now. At the moment, we can at best see the results being formed, and investigate some already existing results.

It should also be noted that the TUTL projects and their starting points vary from one another, and the characteristics of the commercialisation of each discipline need to be considered. Reaching the goals can mean different things for different projects. In medicine, for example, commercialising products is a project of several years or maybe a decade, where as in the field of ICT, commercialisation can be a result of a process of some months.

From the viewpoint of the spring of 2017, TUTL has advanced the creation of the aspired objectives and created a basis for broader impacts. Good launches have been made, and progress has been made also in the on-going projects.

Results that can be seen now are the increased understanding of the potential and demands of commercialisation, the clarification of the paths and plans of commercialisation, the forming of partnerships of commercialisation and the development of an invention/technology into a product that can be better commer-

FIGURE 11. An estimate of TUTL project implementers about how quickly after the end of the project the results will be made use of (Surveys of the evaluation, autumn 2017).



cialised, as well as a finished product. The TUTL instrument has also influenced the processes of commercialisation as well as the development of (technological and commercial) knowledge.

According to many of the implementers of on-going and finished projects, the research done to develop an idea or product into something that can be commercialised, is considered the most important result form TUTL-project. Other results related to precommercialisation (for example, the planning of commercialisation, finding partners for commercialisation, patents, a new spin-off company) have also been brought forward, but it should be noted that product development is regarded as the most important result in many cases. This means that TUTL funding is clearly used also for research purposes. From the perspective of the successfulness of commercialisation and the effectiveness of the funding in these projects, the focus could be more on other, not research related, preparations for commercialisation.

In the finished TUTL projects IP protection of an invention/technology and (in some cases) the transfer of expertise into an existing company and a new start-up/spin-off company have also been clear results. In TUTL projects, commercialising licenced inventions into existing companies has been rare, as the focus is clearly on spin-off companies. According to questionnaire for TUTL-project contact persons, only about 15 % of TUTL-projects plan to commercialize results mainly through existing companies with a license.

According to Tekes' internal monitoring information, by spring 2017 there were 60 new companies created due to TUTL funding, of which 20 were growing international companies. The total cumulative amount of TUTL funding until this date is 138 M€. Regarding the input (financial resources), there is a good number of potential new beginnings of companies, which can yield significant proceedings for the society in the coming years.

In addition, according to the results of surveys carried out in the evaluation, TUTL funding has generated a significant amount of new businesses through new spin off -companies and IPR, especially in projects that have ended more than two years ago. Results of the surveys show that approximately 0,78 new companies and 1,5 new IPR are born per TUTL-project, two years after project completion.

Based on the results of the questionnaire sent to the contact persons of TUTL-projects, estimations were conducted on how many new companies and immaterial rights can be expected from all TUTL-projects that have ended or are still ongoing (380 projects). The estimations are based on reported information from the survey regarding the amount of new companies and immaterial rights two years after project has ended. Presented esti-

TABLE 1. The estimated number of new companies created in TUTL-projects.

	THE NUMBER OF TUTL-PROJECTS	CURRENT STATUS – ESTIMATED NUMBER OF NEW COMPANIES	CURRENT STATUS – ESTIMATED NUMBER OF NEW COMPANIES FROM PROJECTS THAT WOULD NOT HAVE BEEN IMPLEMENTED WITHOUT TUTL-FUNDING (57 %)	ESTIMATED NUMBER OF NEW COMPANIES 2 YEARS AFTER PROJECT COMPLETION	ESTIMATED NUMBER OF NEW COMPANIES 2 YEARS AFTER PROJECT COMPLETION - PROJECTS THAT WOULD NOT HAVE BEEN IMPLEMENTED WITHOUT TUTL-FUNDING (57 %)
Projects that have ended over 2 years ago	158	123 (coefficient 0,78)	70	123 (coefficient 0,78)	70
Projects that have ended 1-2 years ago	72	50 (coefficient 0,69)	28	56 (coefficient 0,78)	32
Projects that have ended less than 1 year ago	58	32 (coefficient 0,56)	19	45 (coefficient 0,78)	26
On-going projects	92	0 (coefficient 0,0)	0	71 (coefficient 0,78)	41
Total	**380**	**205**	**117**	**296**	**169**

mates are based on the assumption that projects completed and ongoing will produce results (after two years of project completion) in the same ratio as projects that preceded them. Results of the survey were then generalized to describe all TUTL projects. The reported information from the survey was also used to make estimations of how many new companies have already been born, at the current moment, from projects of different ages. Because these estimations are based on the survey, they can be considered at best as an indicative interpretation of the matter, as there are number of uncertainties related to this kind of review.

The results of the estimation indicate, that from the 380 already funded completed or ongoing TUTL-projects, some 300 new companies and about 550 intangible rights would be generated two years after the end of these projects. When one takes into account only such projects that would not have been done at all without

TABLE 2. The estimated number of new immaterial rights created in TUTL-projects.

	THE NUMBER OF TUTL-PROJECTS	CURRENT STATUS – ESTIMATED NUMBER OF NEW IMMATERIAL RIGHTS	CURRENT STATUS – ESTIMATED NUMBER OF NEW IPR FROM PROJECTS THAT WOULD NOT HAVE BEEN IMPLEMENTED WITHOUT TUTL-FUNDING (57 %)	ESTIMATED NUMBER OF NEW IMMATERIAL RIGHTS 2 YEARS AFTER PROJECT COMPLETION	ESTIMATED NUMBER OF NEW IPR 2 YEARS AFTER PROJECT COMPLETION – PROJECTS THAT WOULD NOT HAVE BEEN IMPLEMENTED WITHOUT TUTL-FUNDING (57 %)
Projects that have ended over 2 years ago	158	231 (coefficient 1,46)	131	231 (coefficient 1,46)	131
Projects that have ended 1-2 years ago	72	87 (coefficient 1,21)	50	105 (coefficient 1,46)	60
Projects that have ended less than 1 year ago	58	70 (coefficient 1,20)	40	85 (coefficient 1,46)	48
On-going projects	92	66 (coefficient 0,72)	38	134 (coefficient 1,46)	76
Total	**380**	**453**	**258**	**554**	**316**

TUTL-funding (57 % of the funded projects), the corresponding figures are 169 new companies and 316 in-tangible rights respectively.

Taking into account that 138 million euros have been spent in TUTL and 300 new companies can be expected to be generated, the average cost for establishing a new company would be around 460 000 euros. In relation to the funds used for the projects completed 2 years ago in TUTL, the average cost of a new company would be around 350 000 euros. When the substitution effect is taken into account (counting only the companies that would not have been born at all without TUTL-funds), the cost of a new company would be around 618 000 euros.

Altogether, the anticipated results and effects of TUTL are therefore promising in the light of the information received from this review.

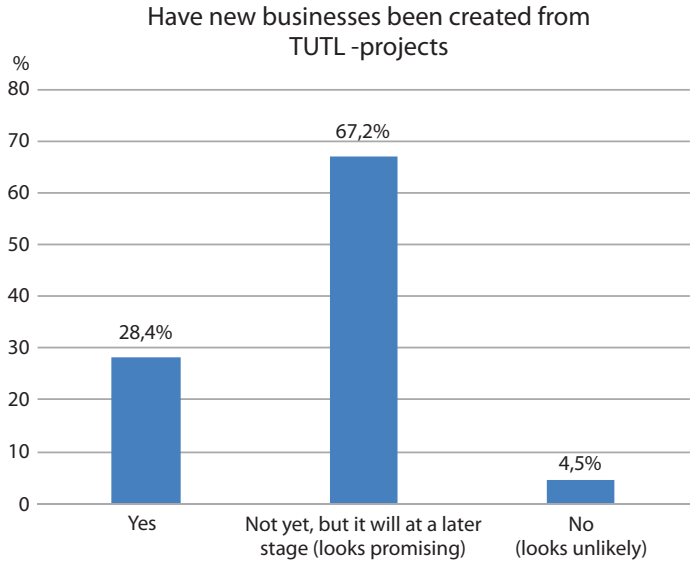
CASE PEPTICRAD AS A SUCCESSFUL PROJECT -EXAMPLE FROM HELSINKI INNOVATION SERVICES

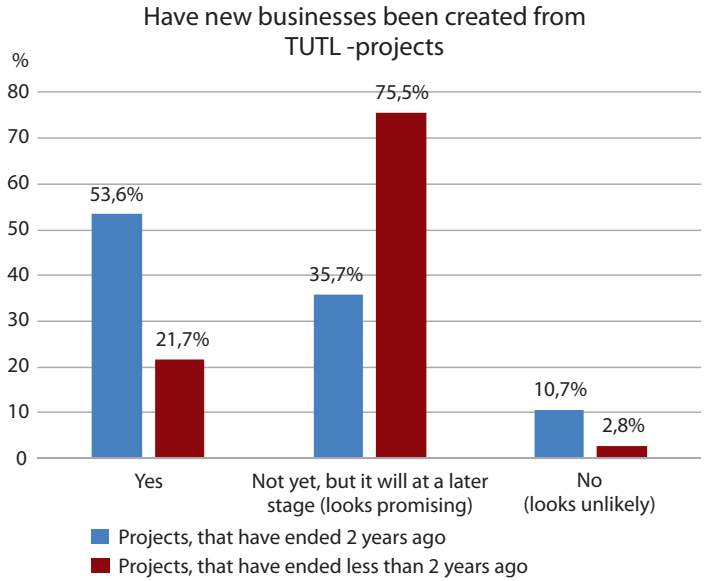
PeptiCrad was a TUTL project at the University of Helsinki that aimed to develop and commercialize the idea to use immunogenic viruses as active carriers of tumour-specific peptides to direct the immune system to specifically target and kill cancer cells. The idea was to combine the best features of two clinically proven cancer immunotherapy approaches, an oncolytic adenovirus and a peptide vaccine. The ultimate mission was to provide cancer patients with less toxic and longer-lasting therapeutic options, where the market potential is huge.

HIS supported the commercialisation process by using its networks abroad and in Finland to find a suitable management team for the commercialisation. A suitable leader from the UK was found for the company, which was to be established as spin-off. The leader had a background as an investor and in the field of medicine. The person in question also made substantial investment to further develop the idea for the next stages in clinical testing.

A new company, Valo Therapeutics Oy, was created from the PeptiCrad project. Since then, the company has collected seed-stage funding worth 7 million euros. Tekes granted Valo Therapeutics a 3-million non-dilutive loan for the preparation of a phase 1 trial, and approximately 3 million euros have been received from private markets. ■

FIGURE 12.
Answers to the question whether there is new business created from TUTL funding or not. On the right, comparison between older and newer finished TUTL projects (Surveys of the evaluation, autumn 2017).





The TUTL-commercialisation process has been more beneficial in organisations in which the supporting processes for commercialisation has been more established and in which TUTL is used as a part of a large, finished commercialisation process or platform of commercialisation (especially some of the Universities and VTT). Innovation Scout has also helped developing processes in many cases, and it has supported the effectiveness of TUTL projects. The TUTL projects clearly yield better results if the process and the plan are ready and if there is previous experience of commercialisation. In such organisations, commercialisation has already been a part of the operation and is strategically acknowledged. Furthermore, they know how to utilise different forms of funding to advance commercialisation. Especially important is using TUTL in combination with other commercialisation measures and in the context of broader plans for commercialisation.

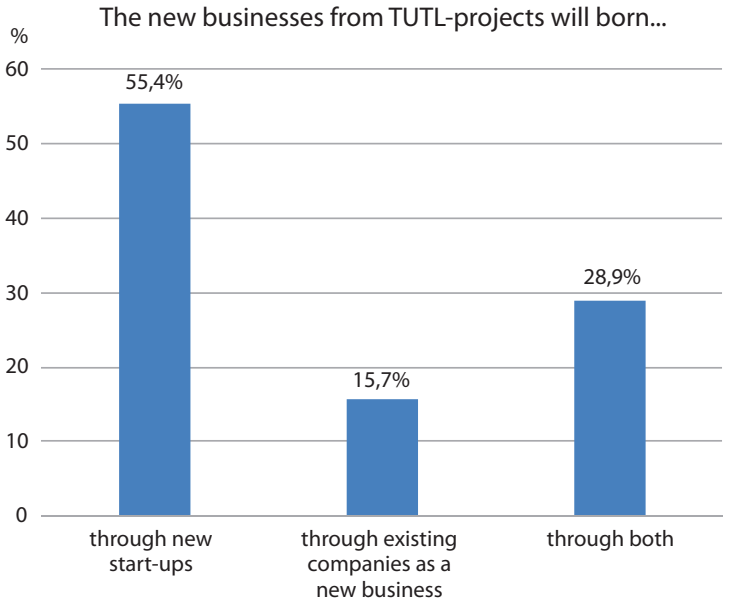
CASE SAIMIA UNIVERSITY OF APPLIED SCIENCES DRIVE! -PROJECT AS AN EXAMPLE OF SUCCESSFUL CO-OPERATION WITH A UNIVERSITY AND OF THE USE OF OTHER FUNDING INSTRUMENTS WITH TUTL

A strength of Saimia has been collaboration with Lappeenranta University of Technology (LUT) in the commercialisation of RDI. LUT concentrates on scientific research and Saimia – on applied RDI activities. All of Tekes' TUTL projects have been joint projects with Saimia and LUT. Saimia has had nine TUTL projects, one Innovation Scout project and one KINO project funded by Tekes.

DRIVE! -project shows that long-term funding continuum has been necessary for commercialization of RDI. The project has succeeded in creating a start-up company. The Tekes TUTL funding (2014–2016) was preceded by funding by the EU (2012) and Technology Industries of Finland (2013). The inventions were created during funding by both the Technology Industries of Finland and Tekes. After the DRIVE! project, a start-up company was established. Tekes is funding the start-up company to scale up the business. ■

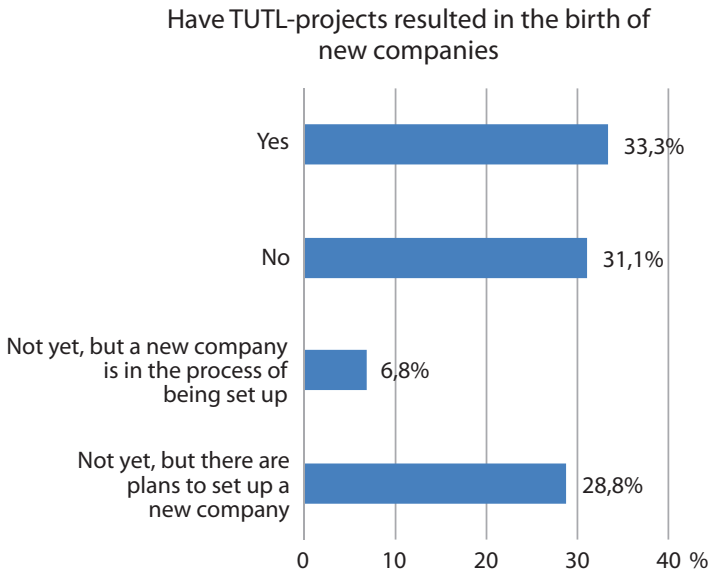
Public organisations that have invested in creating and developing commercialisation expertise have been more successfulness in commercialisation. This has been further enhanced by acquisition of expertise from outside

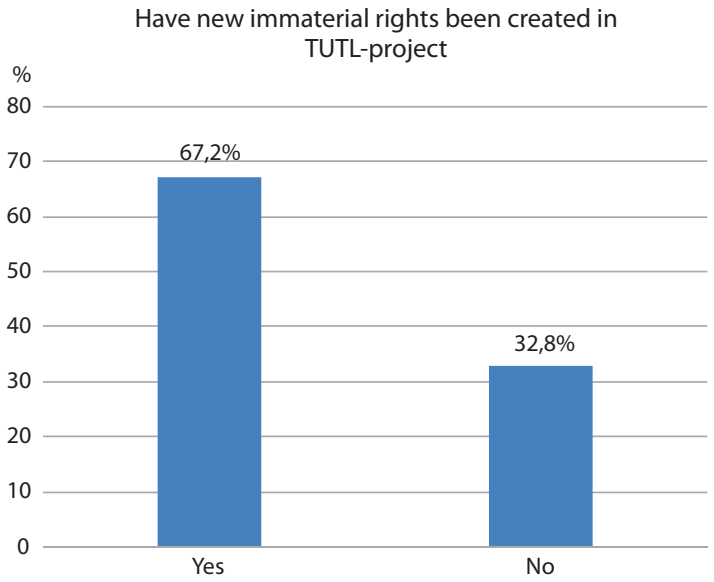
FIGURE 13. The form of the creation of new business from TUTL projects according to project implementers (Surveys of the evaluation, autumn 2017).



of research team. Typically, however, it has been the project teams and researchers themselves who have had the main responsibility of commercialisation. From the perspective of the successfulness of commercialisation, utilising external experts of commercialisation (who bring in networks and broader experience from commercialisation) more often would be beneficial for the effectiveness of the projects in the future.

FIGURE 14.
The forming of new spin-off companies and immaterial rights from TUTL projects (Surveys of the evaluation, autumn 2017).





In TUTL projects, some of the results were not actual initial objectives. These included for example such new ideas that were not based on the original TUTL idea but had commercial potential, and caused alteration of the initial project plan. In addition, networks have been formed with technology developers that maintained co-operation even when the original idea was not commercialised.

CASE COLLABORATION IN TAMPERE LED TO DEVELOPMENT OF AN AWARD WINNING VENTICA DEVICE

The Ventica device measures the expiratory flow of breathing of a child at night. These measurements detect changes in respiration typical to asthma, helping physicians in diagnosing the condition and determining the optimal medication. Ventica was developed in cooperation with TUT, Tampere University Hospital and Helsinki University Center Hospital. The project received TUTL funding in 2013 and won the Health Challenge innovation competition organized by GSK, Mehiläinen and the British UK Trade and Investment organisation in August 2015. As part of the award, opportunities emerged for co-operation in a form of a pilot or research project with the organizers and/or with their assistance. The asthma product was named Ventica in 2016 and received CE marking in early 2017. ■

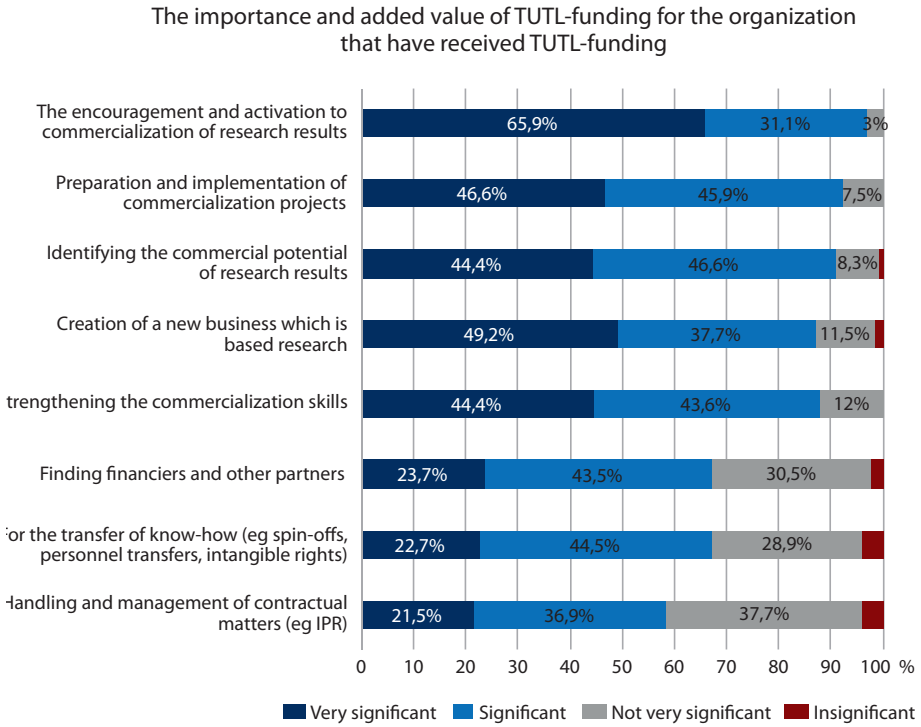
The added value of the TUTL funding has been significant and most of the results would not have been achieved without TUTL funding. TUTL has been especially important in encouraging and activating the commercialisation of research results. TUTL has also been important in the development of practices and tools for commercialisation (preparation and implementation of projects, recognising potential ideas, improving knowledge of commercialisation). TUTL has not yet been equally effective in advancing recipient organisations' ability to commercialise, as enabler of commercialisation, in finding partners for TUTL projects, in transferring research results from projects to companies or in improving management of IPR matters.

For a broader societal influence of TUTL, it is essential how different policy instruments of innovation and different funding combinations can comprehensively support the commercialisation process of innovations (recognising an idea → establishing a path of commercialisation → testing and increasing maturity → involving invertors and other partners → global networks and business). Particularly important and challenging is how well the commercialisation chain is done, who supports it and how. In TUTL, the maturity of the incoming ideas could be increased. Furthermore, project's linkages to funding after TUTL funding could be improved. Support for the implementation of commercialisation could also be improved.

CASE TUTL-PROJECT RESULTED IN A NEW COMPANY WITH BRIGHT OUTLOOKS

Spectral Engines (www.spectralengines.com) produces ground-breaking smart sensor technology, which determines the very make-up of materials. The spin-off was based on TUTL funded research at VTT and represents a generic technology platform, which is applicable to a wide range of industries and has a big growth potential. The company was established 2014 and received seed financing from VTT Ventures, Inventure and Finnvera. The company has been growing fast and has also received international recognition. In 2017, the company won the main prize of €1 mil. in EU's Horizon Prize for food scanners. ■

FIGURE 15. The importance and added value of TUTL funding for the organisations that have implemented projects (Surveys of the evaluation, 2017).



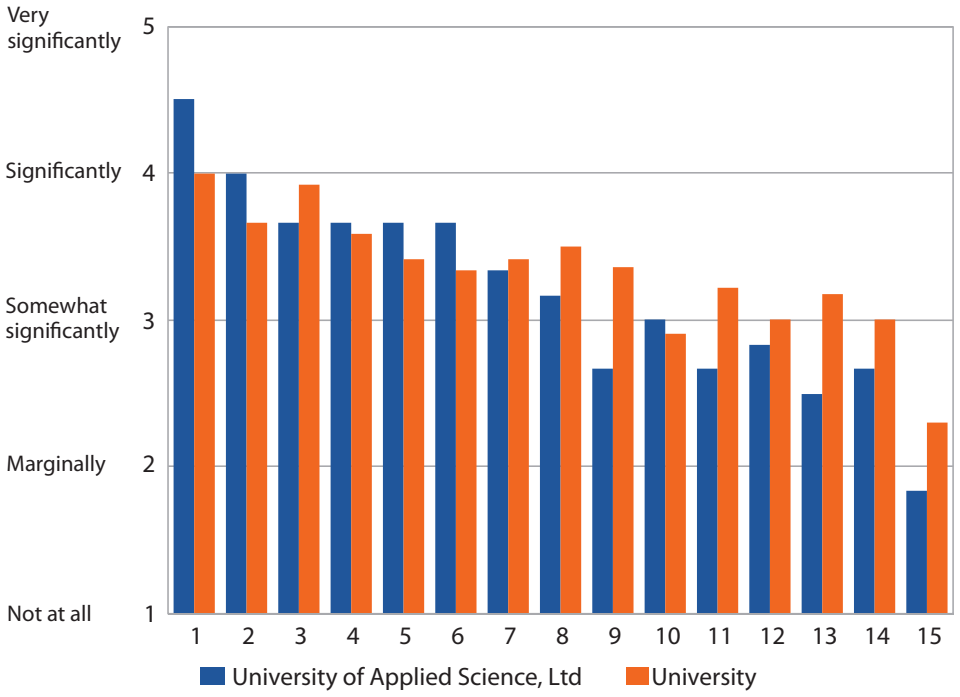
After project completion, it takes several years before results from precommercial activities emerge as a whole. At the moment, there is no tracking after the end of the project. To evaluate the effectiveness of the instruments in the future, systematic, long-term tracking of the development and operation of the TUTL invention ideas, researchers and organisations is needed.

It also presents a challenge for evaluating the results that TUTL projects do not have clearly defined profit targets. More clearly defined objectives would improve realisation of the projects and bring tools for evaluating the effectiveness of the projects. TUTL projects vary greatly and they have very different objectives. Accordingly, setting project specific objectives would help to target area specific differences and give a better ability to monitor achievements.

Regarding Innovation Scout/KINO, commercialisation capacities are developed and both in-house and external collaborations developed. Progress has been made in understanding commercialisation, knowledge of it, the development of the processes and tools of

commercialisation, the development of the analysis of commercialisation opportunities, increased co-operation, and new partnerships with other research organisations and companies, increased the emphasis on the commercial way of thinking as well as the development of networks both locally and internationally. However, the desired extensive change in the culture of commercialisation has not happened so far extensively.

FIGURE 16. The effectiveness of Innovation Scout and Kino in different types of organisations in the different objective areas of the instrument (Surveys of the evaluation, 2017).



1. The development of new operating models and modes that support commercialization
2. Increase in domestic cooperation
3. The abilty to enhance the diffusion of research results and related know-how to businesses
4. The improvement of the ability to innovate and commercialize
5. The improvement of organization's capacity to create research and researcher-driven business activities
6. Development of the process of commercialization of research results
7. Increasement in researchers' innovation and commercialization skills
8. Organizations commitment to the marketing goals of the research results
9. Increase in international cooperation
10. Development of incentives to support the commercialization of research results and the development contract models related to commercialization processes
11. The emergence of new IPR and knowledge transfe related solutions
12. The birth of new research-based startups
13. Increase in the number of commercially significant research ideas and inventions
14. Utilization of research results as a new business in existing companies
15. Improved access to resources of private equity investors

7 NEW IDEAS AND GOOD PRACTICES – COMMERCIALISATION OF RESEARCH IN OTHER COUNTRIES

As a part of the work, the instruments of the commercialisation of research, modes of operation and political actions in other countries were examined. The most essential objective was to compare the actions of Finland to comparable countries and search for doctrines and effective practices from other countries. The countries examined were Canada, Norway and United Kingdom.

In Finland, the financial investments in research and development were greater relative to gross domestic product than in the comparable countries. However, there are many useful and effective doctrines and modes of operation for Finland in the comparable countries. These are related to the creation of incentives, conditions and operation models for the commercialisation of research, which have been successfully utilised in advancing the commercialisation of the research results of research organisations.

CANADA

In Canada, university research and development is a major driver of innovation and economic growth. Canada's universities conduct roughly 41% of Canada's R&D. From the policy-level perspective, Canada provides an example of a country that involves the science pull approach in its innovation policy. Academia-industry partnerships are given the main emphasis in STI policy together with talent development and attraction-related initiatives.

The Idea to Innovation (I2I) programme was launched in 2003 by Natural Sciences and Engineering Research Council of Canada. The programme is a relatively small-scale-grants programme with an average award approximately $90 thousand. The programme aims to accelerate the development of promising technologies and offers

funding at different stages of technological maturation. The program allows faculty members to validate their ideas and get them to the reduced-to-practice stage, where the private sector can clearly see technology's benefits and commit funds to further develop the technology. To access the I2I funds for the enhancement of the technology (Phase II funding), university researchers are required to have a private partner sharing the cost of the project.

The I2I programme of Natural Sciences and Engineering Research Council of Canada is an example of a research commercialisation instrument, which provides funding in phases. Funding divided in clear phases not only supports the different phases of the commercialisation process, but also offers an opportunity to interrupt the process, if it does not proceed. In Finland, phased funding could be a useful addition when used, for example, as pre-TUTL funding for smaller projects, where suitable ide-as to be developed further would be funnelled as actual TUTL projects with bigger funding.

The importance of the Market Assessment Phase of the I2I funding tool is highlighted, as is the importance of thorough demand and market opportunity analysis for technology transfer projects, without the need or potential application areas. Providing a dedicated tool for market analysis and setting it as prerequisite for the following phases ensures that these issues are taken as a starting point for all the funded technology transfer projects.

NORWAY

In Norway, the public sector performs most of the research. The Norwegian Research Council funds research programs and projects, research infrastructures and commercialisation of research results. The government decided to discontinue another major financing instrument for research commercialisation, the Research Fund, from the beginning of 2012, as interest rate fluctuations undermined stable funding. It was replaced by regular funding through the national budget. Performance and indicator-based allocation mechanisms are used in all branches of the public research system, including higher education institutions, research institutes and health trusts, to which 30% of the funds are allocated.

The FORNY program by the Research Council is the most important instrument for stimulating the commercialisation of research results in Norway. FORNY, which stands for Research-Based Innovation, was launched in 1995 and has been continuously running since then, changing its name to FORNY2020 from 2012 onwards. The goal of the program is to contribute to innovation and value creation in Norwegian business by strengthening the ability to commercialize research-based business ideas that arise in the universities and research institutions. The FORNY2020 program offers three types of sup-port: proof-of-concept funding, basic funding for Technology Transfer Offices (TTO) and funding for structural enhancement, network building and compe-

tence building. Funding targeted to TTOs assures the capabilities needed for the research commercialisation activities. TTOs are usually linked to and at least partially owned by a university, but they can serve other research institutions, HEIs and university hospitals in the region. FORNY2020 funds given to TTOs are divided into basic funding and development funding (similar to Innovation Scout funding). These days, widely established technology transfer offices have the most important role in commercialisation, and the efforts made to intensify technology transfer through TTOs in Norway have been found to be a good example for Finland to learn from. Most of the funding, however, is devoted to the proof of concept projects.

Furthermore, in 2016, STUD-ENT was launched as a new form of support aimed at master's students, wishing to invest in a career as an entrepreneur. Student projects can apply for up to NOK 1 million to realize their business page based on the knowledge they have gained through the studies. By directly supporting the students, STUD-ENT is indirectly expected to stimulate increased innovation and entrepreneurship focus in the university and college sectors. STUD-ENT is a trial funding scheme for student projects and serves as a tool for activating universities and other HEIs to pay more attention to student entrepreneurship-related issues. Although the trial was not a complete success, it is an example of how funding instruments can be used as a tool for activation and motivation.

FORNY2020 uses a wide range of indicators and measures on both the project and the instrument level. On the project level, the indicators used in the selection process form a systematic and predictable frame for project selection. On the funding instrument level, the indicators used are gathered from various data sources in order to build a comprehensive picture about the results and impact of the programme. So far, for example, TUTL instruments do not include similar comprehensive measuring and monitoring of the achievement of the objectives.

UNITED KINGDOM

The United Kingdom is an outstanding performer when it comes to science. It has more Nobel Laureates than any country outside the USA. When it comes to innovation and commercialisation of re-search, the picture is a bit different. The United Kingdom performs below the OECD median on several headline indicators, including R&D expenditure and patenting. Industry financed public R&D expenditures as a share of GDP are below the OECD median. However, patents filed by universities and public labs per GDP are well above the OECD median, an indication of the commercial efforts made by UK universities. The UK R&D system is dominated by a relatively small number of large universities, whose performance has a proportionally significant impact on the sector as whole, and by a relatively small number of large corpo-

rates that tend to dominate university-industry collaborations.

Funding for university research in the UK is provided under the Dual Support System. Higher education Funding (HEIF) today is granted based on formula-based allocations, and in the future, the KE strategies of HEIs will also be taken in the account. Hence, the funding model is not only based on past behaviour, but will also focus on future intensions and, as such, encourages HEIs to make strategic decisions.

The UK's HEIF funding model is just one example of comprehensive funding models that are targeted for third-stream activities of HEIs. It gives HEIs freedom to emphasize those areas of third-stream activities that fit their strategies or, to put it more frankly, forces HEIs to form strategies related to third-stream activities.

The Ministry of Education in Finland is criticized for not taking account of third-stream activities in their funding model, especially in the case of universities. The HEIF funding model offers a good benchmark, which gives universities the freedom to concentrate on third-stream activities they find important, which at the same time, gives the Ministry a solid base for funding allocations.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

There is no doubt about the significance and added value of TUTL and Innovation Scout to research organisations. As a method of funding the commercialisation of research, they have successfully been filling the gap in the national innovation funding system between the funding for applied research and the funding for companies. The funding from Tekes (Innovation Scout and TUTL) has practically been the only instrument with which to advance research-based, IPR intensive innovations from the perspective of commercialisation. In this respect, there has been a clear demand and societal need for TUTL and Innovation Scout. The Tekes funding, which supports commercialisation, has also supported the aims of the government policy statement in improving the effectiveness of research and innovation operations, and it has been justifiable because the industry and research organisations/universities are not investing enough in commercialisation relative to the societal proceedings.

The added value of TUTL and Innovation Scout funding is large and the leakage effect small. Most of the projects realised with the funding of TUTL and Innovation Scout would not have been realised or would have been only partially realized without the funding of Tekes. Similarly, most of the results would not have been created without TUTL or Innovation Scout. Therefore, the funding does not replace the funding of the Universities or other funding for commercialisation. Further, it does not seem to have discriminatory effects in the organisations that received funding or in the operating environment of commercialising research.

The TUTL instrument has been a somewhat efficient form for projects. Compared to the predecessor, Tekes' TULI funding, TUTL has clearly been more efficient and direct as an instrument supporting commercialisation. Even though TUTL has only been active a short while and the final results and impacts are taking shape, the preliminary results show that it works more cost-effectively and efficiently than TULI if the objectives are commercial results for example in the form of new start-ups and new business.

The added value and significance of TUTL and Innovation Scout can be seen in the following things, among others:

- With the help of the funding, structures and processes of commercialisation have successfully been created, and there has been a positive influence on the strategic position of commercialisation in research organisations.
- The Tekes funding has increased the abilities required for IPR and commercialisation in organisations, and made commercialisation a more familiar phenomenon.
- The Tekes funding has given the mandate and resources to focus on the commercialisation of research and increased the use of company funds on commercialisation.
- The Tekes funding has strengthened the co-operation with companies and opened new connections to investors as well as research infrastructures outside one's own organisation.
- The research organisations' ability to commercialise has increased clearly during the last 3 years.
- The funding has reinforced the commercialisation procedures in research organisations.

Since the year 2012, close to 138 M€ of TUTL funding has been granted for research organisations. Because of the nature of the funding (precommercial funding) and the existing tracking information, it is currently impossible to estimate the final effectiveness or cost-effectiveness of the funding. According to Tekes' internal monitoring information, by spring 2017 there were 60 new companies created due to TUTL funding, of which 20 were potentially successful international growth companies.

According to surveys of the evaluation and case studies, a significant amount of new business has been created through new companies and the transfer of IPR especially in the projects that have finished more than two years ago (according to survey 0,78 new companies per TUTL project and 1,5 IPR per TUTL project). Based on the estimations carried out in the research regarding the ongoing or already completed projects, more than 300 new companies can be anticipated to be created from TUTL projects and 170 of them as a sole influence of TUTL. Taking into account that 138 million euros have been spent in TUTL and 300 new companies can be expected to be generated, the average cost for establishing a new company would be around 460 000 euros. Furthermore, over 550 IP-rights is estimated to be created in TUTL-projects, of which over 300 from the sole contribution of TUTL. In the light of the above-mentioned information, the results and predicted impacts are extremely promising.

The TUTL evaluation (2012) brought forward three main observations or improving suggestions regarding the funding of the commercialisation of research: 1) move from competence building to producing commercial results, 2) synergies need to be exploited better and 3) the long-term commitment needs to be ensured and attention needs to be paid to the activation of pri-

vate funding. TUTL has been successful in employing the concrete transfer to producing and commercialising commercial results as well as indirectly activating private funding. On the other hand, the questions brought forward by the TULI evaluation about utilising synergies and committing to the objectives of commercialisation have continued to be big challenges for the commercialisation of research. The commitment of the (boards of) organisations and the strategic prioritisation of commercialisation objectives is crucially important here.

TUTL and Innovation Scout have been an important and effective tool for research organisations. As a funding instrument, they fill the gap in the funding of the commercialisation of research for which they were meant. In our national innovation system and funding, there are challenges and defects, which require new types of structural and systemic solutions. In relation to TUTL and Innovation Scout, it should be remembered that they are not meant for reforming the innovation system but primarily fulfil the needs of the current systems that have to do with activating commercialisation in research organisations and the lack of funding in passing "the Valley of Death" phase. Here TUTL and Innovation Scout have been quite successful, and it seems that a similar funding service is needed in the future. Other types of solutions and tools are needed for solving the "big" challenges of our innovation system and funding.

8.2 RECOMMENDATIONS FOR TEKES / BUSINESS FINLAND

TUTL and Innovation Scout are extremely important to research organisations and their added value is large. The funding from Tekes has been critically important for commercialising research as well as creating cultural change in research organisations. Similar funding is needed in the future, but the conditions could be changed to take the specific needs of different fields into account better and to further improve the effectiveness of the funding.

Recommendation 1. A precommercialisation funding like TUTL and Innovation Scout is necessary in the future. There is no funding for the purpose other than TUTL. Regarding the activation and funding conditions, it should also be considered how new potential commercialisation preforms could be involved that have not yet received funding. Such means could be for example activating research organisations and increasing project counselling.

Recommendation 2. The number of project applications is decreasing and at the same time, a lot of commercially potential inventions will not be exploited. Funding is for the most part focused on technology, electronics, medicine and bio and chemistry sectors. Much interesting research and commercially potential ideas remain out of these areas, and will not be com-

mercially developed further using TUTL. Activation and funding conditions should be developed in the future so, that inventions, ideas, research teams and organizations from the sectors that have yet remained outside from TUTL-funding, would also be included. What is needed to achieve this is the activation of these research organizations, more effective project advising system and also strengthening and widening the knowledge of Tekes' own experts.

Recommendation 3. Different scientific fields and research fields have different needs regarding time and investment. The differences should be noted better in the project criteria of TUTL. A possible solution is for example continuous search for projects and a tailored selection process for projects (cf. the normal company projects of Tekes).

Recommendation 4. One way to consider the different nature of projects and time that they need in different fields is dividing the funding into different operations for the commercialisation process. In this way of funding, it is important for granting funds that the previous phase in the commercialisation process is successful according to the nature of innovation processes.

Recommendation 5. The results of the evaluation show that projects spend an unreasonable amount of funding for research. For successful commercialisation and for the effectiveness of the funding, preparation for commercialisation should be more emphasised in the project criteria, and customer demand and solution-orientation should be the basis for funding and instruction.

Recommendation 6. The instructive impact of TUTL for the commercialisation of research would be stronger if the projects had indicators based on their own goals which describe their results and intermediate objectives, and which have a tracking system. A similar tracking system should be created on the upper level also for the TUTL programme.

Recommendation 7. Together with the Team Finland operators, Tekes could support, coach, and create procedure concepts for the transfer to research and starting a business. Similarly, new paths are needed for further funding of TUTL projects and bridge financing after the project.

Recommendation 8. In addition to TUTL, a flexible funding instrument should be considered (50–100k euro), with which to test ideas (like TULI) before TUTL funding. This could be suitable for example for organisations that do not have the process or resources to search for ideas suitable for TUTL. At the same time, it would increase the amount of ideas that can get funding for commercialisation as well as the effectiveness of the funding.

Recommendation 9. TUTL and Innovation Scout have reinforced the knowledge of commercialisation in organisations greatly. The impact of Tekes funding could be increased by closer co-operation between organisations. There should be co-operation structures that support learning and new partnerships (for example, access to international networks) between projects and between research organisations (commercialisation organisations).

Recommendation 10. The gap between the funding from the society and the first investor is still a big challenge for commercialisation. New procedures should be created for creating partnerships between research organisations, companies and investors, and stronger incentives should be created.

Recommendation 11. TUTL should search for collaboration advantages regarding different existing problems of commercialisation. For example, programmes such as Spark work well as platforms after the brainstorming fund for developing ideas and preforms with TUTL funding.

8.3 RECOMMENDATIONS FOR PUBLIC RESEARCH ORGANIZATIONS IN FINLAND

The reforms of the recent years have given universities and colleges more independence regarding the planning and organising commercialisation and industrial co-operation, and they have given the opportunity to invite private investors and make one's own investments. Due to the invention law of universities and colleges, universities have better rights regarding their own inventions, and it has encouraged the commercialisation of the results of R&D work. At the same time, it has created ambiguities between researchers and the university regarding the ownership of the research profits. Another challenge is that Universities still do not have their own ambitions or incentives for commercialisation, and succeeding in commercialisation does not affect their basic finances. Further, the national R&D&I system and funding are both regionally and organisation-specifically fragmented, which can be seen as big differences between colleges, universities and research organisations in commercialisation.

Recommendation 12. A public funding system and testing model that supports cultural change, such as Innovation Scout, is needed in the future as well. Alongside this, a tool is needed to make the change continuous and permanent. Here the research organisations should be more ambitious and use their own funding to support the stability of the culture of commercialisation. The role of Tekes and any public actor should be to enable operations, not to initiate and to lead the way, as it is now.

Recommendation 13. There should be more collaboration between universities and colleges, and service supply could be directed across universities by for example founding joint commercialisation organisations or having the commercialisation organisations of universities share their services, knowledge and networks to other universities.

Recommendation 14. The differences between research fields should be noted better in the project criteria and funding by TUTL. Research organisations and research groups could, together with the experts of Tekes, consider how TUTL could be customised to fill the needs of different scientific fields (for example, time and investment needs).

Recommendation 15. In their TUTL applications, the research groups could be asked to model their paths/ dynamics of commercialisation better and to produce intermediate objectives and indicators for reaching the commercialisation objectives.

8.4 RECOMMENDATIONS FOR RESEARCH AND INNOVATION POLICY

In this evaluation, the focus point has primarily been on the evaluation and development needs of TUTL and Innovation Scout investment instruments. Questions arose regarding the national research and innovation environment, but it was not within the scope of this evaluation to delve further into those questions. However, the observations of this evaluation support the conclusions brought forward by the OECD Evaluation of Finland (2017) regarding, among others, the challenges of the national innovation environment in getting research results and new ideas to global markets, the lack of a target-oriented approach and an overall view as well as the development needs of knowledge-based growth. OECD and partly the national Research and Innovation Council have brought forward ideas about the importance of the development of national research and innovation system as a whole, the need for increasing interaction between research and business, the necessity of internationalisation of the innovation system and R&D operations as well as the necessity for a research and innovation vision, which are important factors in the operational environment also for the success of the commercialisation of research.

Recommendation 16. Based on the OECD land evaluation, Finland needs a new vision for the national research and innovation operations. A joint political vision and strategy are also needed as part of the general national vision.

With TUTL and Innovation Scout, the culture of commercialisation has been successfully reinforced in research organisations. The commitment of the management to the commercialisation goals is weak, and the commercialisation goals are not essential in the strategy. The guidance of Ministry of Education and Culture does not support the commercialisation goals and the universities and colleges do not have significant commercialisation incentives.

Recommendation 17. The government should consistently create new tracking models and incentives for commercialisation and collaboration between companies.

Recommendation 18. New models and incentives need to be created to increase the mobility of experts between the business world and the research world.

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APPENDIX 1. INTERNATIONAL BENCHMARKING

TUTL BENCHMARKING CASE – CANADA

1 BACKGROUND AND CONTEXT

1.1 COMMERCIALISATION OF RESEARCH IN CANADA

University research and development is a major driver of Canadian innovation and economic growth. Canada's universities conduct 41 per cent of Canada's R&D. It is estimated that post-secondary institutions produce over $55 billion annually in economic activity and support around 680,000 direct and indirect jobs. Universities are a key partner in industrial R&D by conducting over $1 billion in research for business annually.[3]

The University sector continues to rank second in research expenditures after private sector research in Canada. In the period between 2002 and 2012 higher education spending on research has increased by approximately 55% while real spending on research by the private sector has declined since the economic downturn of 2008. The Federal governments expenditures in support of basic research have, by contrast, remained essentially the same, in real terms, since 2007 and have recently began to shrink. Provincial support of research and development varies widely from province to province. The majority of funding from provincial sources is concentrated in Quebec, Ontario, British Columbia and, Alberta.[4]

In international comparison (Figure 1), Canada ranks below OECD average in R&D expenditure. Within the G7 group Canada has the largest proportion of higher education sector R&D (39.8%) but the smallest proportion of private sector R&D (50.5%), the share which has fallen by 6.6% between 2003 and 2013.[5]

Canada has no national policy on the ownership of intellectual property ("IP") arising from federally funded research. In contrast to the Bayh-Dole system in the United States, IP derived from public research dollars is owned in accordance with the policies of the University where the research was conducted. The lack of a coherent policy on arising intellectual property has precluded Canada from developing the type of systematic structure for the commercialisation of IP by Universities. Across

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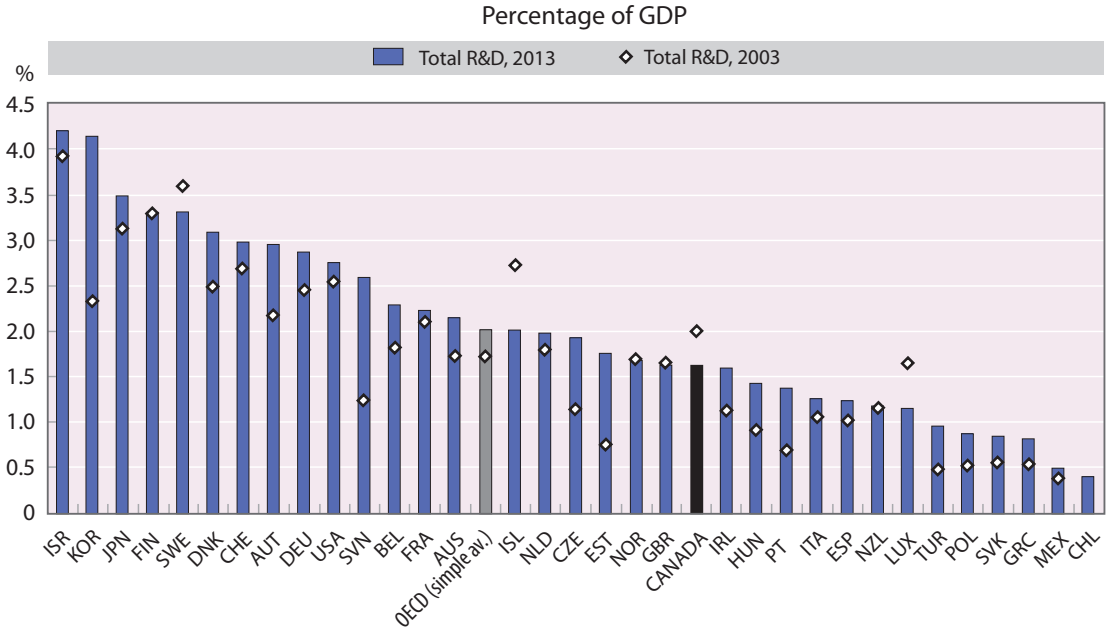
[4] University intellectual property and technology transfer, Universities Canada, June 2017.
[5] OECD (2017): SME and Entrepreneurship policy in Canada, OECD Publishing, Paris.

FIGURE 1. Gross domestic R&D expenditure across OECD countries 2003 and 2013.[6]



Canada, there are three broad categories of IP policies governing federally funded as well as other research expenditures: (a) Institution owned, (b) Creator owned, and (c) Hybrid.[7]

1.2 ORGANIZATION AND RESULTS OF RESEARCH COMMERCIALISATION

Natural Sciences and Engineering Research Council of Canada (NSERC) aims to make Canada a country of discoverers and innovators for the benefit of all Canadians. The agency supports university students in their advanced studies, promotes and supports discovery research, and fosters innovation by encouraging Canadian companies to participate and invest in postsecondary research projects.[8]

The NSERC Idea to Innovation (I2I) program launched in 2003. It is a relatively small-scale-grants program with an average award approximately $90 thousand. The program aims at accelerating development of promising technologies and offers funding at different stages of technological maturation. The program allows faculty members to validate their ideas and get them to the reduced-to-practice stage where the private sector can clearly see the technology's benefits and commit funds to further develop the technology. To access the I2I funds for enhancement of the technology (Phase II funding), university researchers are required to have a private partner sharing the cost of the project. The I2I has funded more than 590 projects worth more than $53 million.[9]

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6 OECD (2017): SME and Entrepreneurship policy in Canada, OECD Publishing, Paris.
7 University intellectual property and technology transfer, Universities Canada, June 2017.
8 NSERC web pages, visited 28.10.2017
9 Galusko-Sagynbekov (2014): Commercialization of University Research in Canada: What Can We Do Better? International Journal of Business Administration Vol. 5, No. 5; 2014.

The I2I Grants provide funding to college and university faculty members to support research and development projects with recognized technology transfer potential. This is achieved through defined phases by providing crucial assistance in the early stages of technology validation and market connection.

1.3 HISTORY OF AND REASONING FOR FUNDING INSTRUMENT

Unlike several other comparator countries in the OECD, Canada does not have a stand-alone fund dedicated to supporting university IP development or its private sector uptake. An important program that had filled this role in the past was the Intellectual Property Mobilization (IPM) program. The IPM program was a tri-council initiative established in 1995 and initially funded by the Natural Sciences and Engineering Research Council of Canada (with Canadian Institutes of Health Research and the Social Sciences and Humanities Research Council of Canada joining in 2001). Throughout the 14 years of the program, more than 107 institutions participated in over 100 grants, totaling $59 million.[10]

The IPM program was specifically designed to encourage collaboration between technology transfer offices in order to facilitate sharing expertise between institutions. It led to a number of enhancements to the Canadian IP ecosystem, including:

- an increase in universities partnering with small companies lacking expertise in IP development;
- the development of the Quebec commercialisation hub, the Société de valorisation des applications de la recherche (SOVAR);
- the creation of the WestLink program, a network internship training program which places graduates into institutional technology transfer offices, venture capital firms, and technology companies in the prairies; and
- the establishment of the Springboard commercialisation network in Atlantic Canada.[11]

In 2009, the IPM program was discontinued despite evidence that demand for the program's funding had increased and the initiatives it supported had allowed more researchers to be involved in technology transfer activities than ever before. After this period, staffing for university commercialisation declined while the growth that Canada had enjoyed in knowledge translation slowed.[12]

Systematic funding targeted to technology transfer or research commercialisation projects started in 2003 with NSERC's I2I program. In addition to I2I program,

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10 Evaluation of the Intellectual Property Mobilization program, NSERC, April 2008.
11 University intellectual property and technology transfer, Universities Canada, June 2017.
12 University intellectual property and technology transfer, Universities Canada, June 2017

also Canadian Institutes of Health Research (CIHR) has a program called Proof of Principle (POP) launched in 2001. The program encompasses discoveries in health sciences, anything from diagnostics to devices and to drugs. It provides funding for up to $160,000 per grant with the possibility to allocate up to 20% of the requested budget for eligible expenses incurred in the commercialisation stage including patenting cost, legal fees, market research cost, and others. The POP program offers two phases for grant application. For Phase I, partnership with the industry is not required; however, an innovation has to be at a stage where IP protection can be applied and a clear path to commercialisation is identified. Phase II is aimed at providing a platform to better enable the academic institution/researcher to move the discovery/invention further down the innovation pipeline and requires participation of industry.[13]

It has to be mentioned that the science and innovation policy in Canada highlights three areas: talents, discovery and innovation. When it comes to innovation, the main emphasis is clearly on academia-business partnerships, not in technology transfer activities as such. The I2I –program, which is the most extensive technology transfer program in Canada, can be regarded being a rather small-scale initiative. Utilization of research results is seen mainly pull-type of activity based on the existing needs rather than a science push activity which tries to find need for technology inventions.

2 DESCRIPTION OF FUNDING INSTRUMENT

2.1 TARGET AND FORMS OF FUNDING INSTRUMENT

The objective of the Idea to Innovation (I2I) Grants is to accelerate the pre-competitive development of promising technology originating from the university and college sector and promote its transfer to a new or established Canadian company. The I2I Grants provide funding to college and university faculty members to support research and development projects with recognized technology transfer potential. This is achieved through defined phases by providing crucial assistance in the early stages of technology validation and market connection.[14]

Four distinct funding options are proposed, which are characterized by the maturity of the technology or the involvement of an early-stage investment entity or an industrial partner. In the Market Assessment, NSERC will share costs of an independent and professional market study with the institutions (including the industry liaison office ILO or Technology Transfer Office TTO). In Phase I, the direct costs of research will be entirely supported by NSERC; in Phase II, they will be shared with a private partner. The technology development may begin with a Phase I project (Reduction-to-Practice Stage), followed by a Phase II project (Technology Enhancement) or, if the development is at a later stage, it can start directly with a Phase II project. In any case, the combi-

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[13] Galusko-Sagynbekov (2014): Commercialization of University Research in Canada: What Can We Do Better? International Journal of Business Administration Vol. 5, No. 5; 2014.
[14] NSERC wbe pages, visited 28.10.2017

nation of Phase I and Phase II will be limited to a maximum of three years' funding for any given project.[15]

2.2 FUNDING VOLUME AND TERMS[16]

In I2I –funding eligible research and development activities include (but are not limited to):

- refining and implementing designs;
- verifying application;
- conducting field studies;
- preparing demonstrations;
- building prototypes; and
- performing beta trials.

Eligible technology transfer activities, in turn, include (but are not limited to):

- consulting fees to develop the strategy to protect the technology's commercial value;
- market investigations;
- consulting fees for business plan, market survey, etc.;
- business mentoring by experienced entrepreneurs;
- sharing of patenting expenses; and
- expenses associated with creating a partnership (such as travel, etc.).

Market Assessment Phase

Market Assessment projects are designed to enable institutions to do a market study for a product, process or technology they plan to develop. Understanding market potential is crucial when developing a new technology. The Market Assessment funding option is a tool to help identify industry and market issues.

The aim of the market assessment should be to address questions such as:

- What is the problem or opportunity?
- What is the frequency or extent of the problem or opportunity?
- Who is looking to solve the particular problem or take advantage of the opportunity, and are they willing to pay to solve it?
- What is the proposed solution to address this identified problem or opportunity, and who will pay for the solution?
- Why has this problem not been solved already?
- What barriers exist? What is being proposed to overcome the barriers? How is it different from existing solutions, and why will someone choose the proposed solution instead?

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15 Galusko-Sagynbekov (2014): Commercialization of University Research in Canada: What Can We Do Better? International Journal of Business Administration Vol. 5, No. 5; 2014.

16 NSERC wbe pages, visited 29.10.2017

NSERC will co-support up to three-quarters of the costs of the project contracted out to a consultant, with the institution providing the balance in cash. Funding is available for up to 12 months, with a maximum contribution from NSERC of $15,000.

Phase I – Reduction-to-Practice Stage

Phase I reduction-to-practice projects are designed to advance promising technologies in order to attract early-stage investment and/or to build valuable intellectual property (e.g., strengthening the commercial value of the technology, broadening patent claims or strengthening licensing opportunities) in anticipation of transferring the technology to a new or established company.

One of the main reasons why Phase I proposals are rejected is that the technology is at too early a stage to be eligible for the I2I Grants. Phase I proposals must be based on strong scientific evidence and present the following elements:

- The technology must be sufficiently mature. The basic parameters of the concept must have already been explored, and sufficient testing should have been done to assess the potential of the innovation to work in a "product" environment or for its intended purpose.
- There must be a clearly identified and well-described potential market. Meaningful letters of support from potential receptors, end-users/clients and industrial value-chain players may be very useful.
- The content of the technology transfer section should address the essential questions asked through the market assessment portion.
- Involvement of experienced business mentors is recommended when the team is planning to spin off a new company.

A company may be involved as a testing bed for the technology (i.e., potential client). However, when a collaborating company is the intended receptor for the technology (i.e., the company that will market the end product), the cost of the project should be shared with this partner and the application submitted as a Phase IIb proposal.

Funding is available for up to 12 months, at a maximum of $125,000, and is non-renewable. NSERC will assume 100 percent of the direct costs of research for Phase I projects.

NSERC offers an I2I Phase Ib supplement. This funding, up to $60,000 for six months, can be made available for successfully completed Phase I projects with high promise to secure an investor or a licensing company.

Phase II – Technology Enhancement

Phase II projects are designed to provide scientific or engineering evidence establishing the technical feasibility and market definition of the technology, process or product. Phase II projects require an early-stage investment entity (Phase IIa) or a company (Phase IIb) to share the costs of the project. The supporting organi-

zation is expected to participate actively in the planning of the project. The proposals fall into two categories according to the partner involved as described below.

Phase IIa – Early-stage Investment Partner

Proposals with an early-stage investment entity must be designed with a "go/no-go" decision point, after six to 18 months, representing the achievement of a predefined scientific or engineering milestone that justifies moving forward by further developing the technology either through a new (i.e., start-up) or established company. NSERC can support up to two-thirds of the costs of the project with the early-stage investment entity providing the balance in cash. Funding requested from NSERC should not exceed an average of $125,000 per year.

- The partnering firm must provide input into the technology transfer plan and contribute at least a third of the funds required for the project.
- It is expected that the collaborator has the financial strength to carry the project into Phase IIb or directly to market. If this seed funding will support a spin-off or entrepreneurial start-up, the financial standing of the firm will be closely scrutinized in the evaluation.
- The technology transfer terms must be disclosed.
- The science has to be substantiated to the point that its end product is easily identifiable.
- Thorough market research is required and potential buyers/markets must be specified. Meaningful letters of support from potential receptors, end-users/clients, industrial value-chain players are very useful.
- Well-justified budgets are a prerequisite, and indications of future financial requirements, as well as the plan to secure these funds, should be provided.
- Involvement of experienced business mentors is required when the team is planning to spin off a new company.

Projects that achieve critical milestones may be pursued during another six- to 24-month period with either the newly created company or an established Canadian company providing the cost-sharing arrangement for Phase IIb projects are met.

Phase IIb – Partnership with a Canadian Company

Most of the requirements for Phase IIa listed above also apply to Phase IIb applications. As well, if the development of the technology was supported by a previous I2I phase, proof that the objectives of the earlier project were achieved must be provided, specifically:

- the "prototype" must already be in existence;
- a strong business plan is required;
- involvement of experienced business mentors is required when the team is planning to spin off a new company;
- the receptor capacity to manufacture, distribute, li-

cense, etc. must be substantiated;
- adequate budgets are required to show that the product will be at the marketing/manufacturing stage at the end of the Phase IIb Grant; and
- the "in-kind" contributions should be fully justified as they will be carefully scrutinized.

Phase IIb proposals with a Canadian company are expected to be completed within two years, and funding requested should not exceed $350,000 for the duration of the project. NSERC may fund up to half the cost of the project, with the company providing the other half through a combination of cash and in-kind contributions. Each case will be evaluated on its merits; however, it is expected that the cash component should equal at least 40 percent of the amount requested from NSERC.

The industrial partner must have, or be able to acquire by the end of the project, the technical capability to undertake any further development necessary to take the product or process to market. The company receiving the technology should be prepared to carry out a market study, product/process development, engineering, and sales and marketing planning required to establish that a technology is viable, and to enter the market successfully.

The ILO or its equivalent is expected to assist the applicant(s) and the partner in developing proposals, identifying markets and negotiating licensing or other such arrangements.

TUTL BENCHMARKING CASE – NORWAY

1 BACKGROUND AND CONTEXT

1.1 COMMERCIALISATION OF RESEARCH IN NORWAY[17]

Norway has one of the world's highest incomes per capita, owing in part to its rich and prudently managed natural resources (hydrocarbons in particular) but also to a highly productive economy, including business services.

The public sector is a major research performer in Norway. The government decided to discontinue the Research Fund from the beginning of 2012 as interest rate fluctuations undermined stable funding. It will be replaced by regular funding through the national budget. Performance and indicator-based allocation mechanisms are used in all branches of the public research system, including higher education institutions, to which 30% of the funds are allocated, research institutes and health trusts.

In Norway, the country's productivity performance indicates a level of innovation activity above what the country's rather modest GERD (1.69% of GDP in 2010) would suggest. BERD (0.87%) is below the OECD median (Performance index (d)) but entrepreneurship indicators, notably venture capital (Index (h)), exceed this benchmark. Indicators related to the science base (indexes a, b and c) are around or slightly above the OECD median. Norway's RTA in environment-related technologies is strong and has increased significantly over the past decade (RTA figure). It is underspecialised in bio- and nano-technologies and ICT, despite some improvement. The ICT infrastructure is very strong and near the top of the OECD. Aspects of commercialisation, especially the filing of patents by universities and public labs, are moderate (Index (p)). (Figure 1)

1.2 ORGANIZATION AND RESULTS OF RESEARCH COMMERCIALISATION

In Norway, universities and other HEIs get their basic funding from the Ministry of Education and research institutions from the Norwegian Research Council. Research Council also funds research programs and projects, research infrastructures and commercialisation of research results.

FORNY2020 (originally FORNY) is the central funding of Research Council targeted to support commercialisation of research results. The commercialisation process together with role of FORNY2020 is presented in Figure 2.

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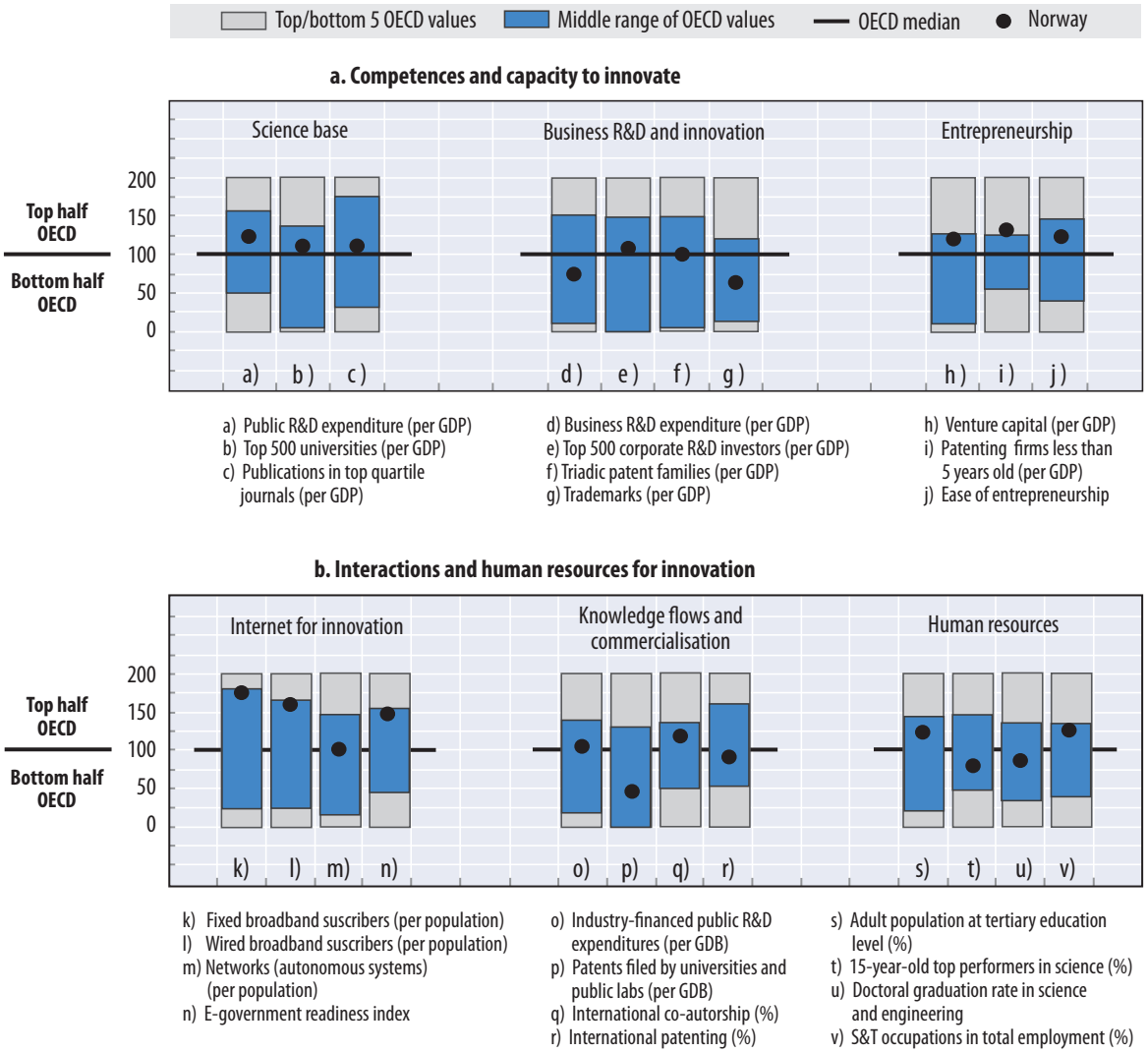
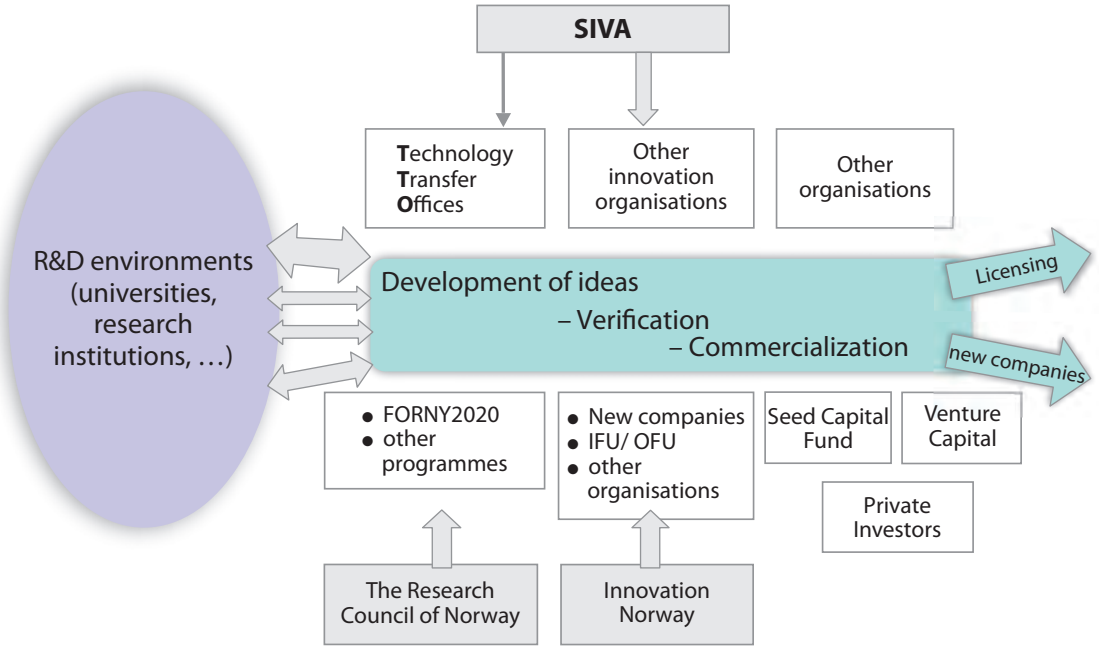
[17] https://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/norway.htm visited 20.10.2017.

FIGURE 1. STI performance in Norway compared to OECD average. Source: OECD STI outlook Norway report, 2012.



Note: Normalised index of performance relative to the values in the OECD area (index median = 1000)

FIGURE 2. The role FORNY2020 in the research commercialisation.[18]



In FORNY2020 (originally FORNY) funding is targeted both to individual projects and to Technology Transfer Offices (TTOs) affiliated with research institutions. The program seeks to:

- promote the establishment of new companies based on research results;
- generate growth in existing companies by providing funding to projects based on research results;
- enhance the professionalism and efficiency of the TTOs affiliated with universities, university colleges, hospitals and independent research institutes in their respective fields.[19]

FORNY2020 has no priority thematic, sectoral and business areas, but supports projects with high-expected commercial returns or other social benefits regardless of industry. The allocations in 2016 are divided into the following sectors:

- 29% – information and communication technology
- 29% – Medical Technology / Medicine / Diagnostics
- 14% – Offshore / Petroleum
- 8% – Marine / Aquaculture
- 4% – Material Technology
- 16% – other.[20]

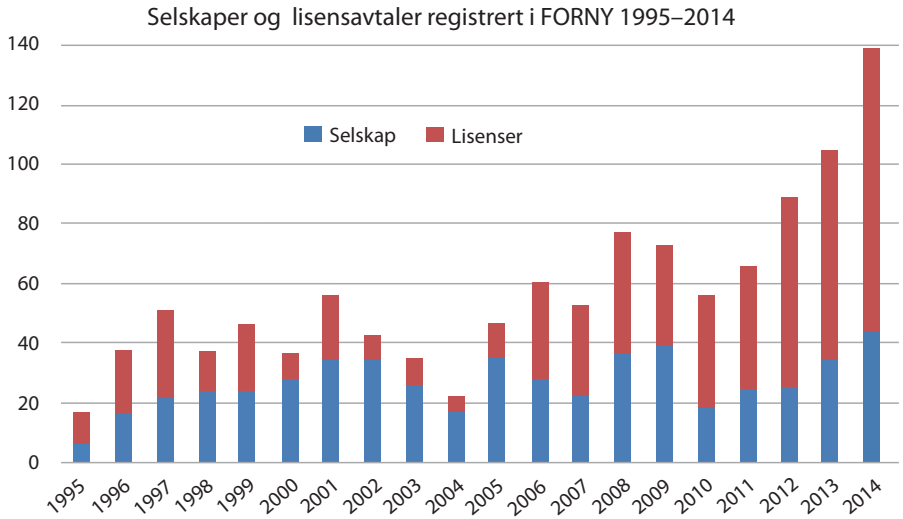
[18] Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

[19] Modified from FORNY2020 webpage visited 18.10.2017.

[20] Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

Throughout the years the program has been operating, a systematic record has been obtained of the results achieved through the various commercialisation actors that have been supported by the program. The most important reporting indicator is the number of commercialisation cases in the form of establishment of new companies and license agreements. Figure 3 shows a comprehensive overview of the results for the entire period 1995–2014.

FIGURE 3. Key results of FORNY 1995–2014; established companies and license agreements.[21]



As shown in Figure 3, there has been quite a significant development. The first few years had a fairly rapid rise to around 40 commercialisation cases per year, and remained at this level until 2002, but then fell to around 20 in 2004. After that, there has been an increase in the period 2005–2010 went up and down with variations between 40 and 80 commercialisation, whereas from 2010 there has been a significant increase with more than doubling the number of commercialisation to 140 in 2014. In the period up to 2003–2004, there was a clear overweight of company launches. Later there has been an increasing proportion of licensing, especially in recent years.[22]

The FORNY tracking results for 2016 show a positive increase in all key figures compared to 2015, and all key ratios are at their highest levels in 2016 compared with the full 5-year period. It should be expected that it will take a few years from an increase in FORNY's budget to give rise to innovation results, so it is very positive that in the last 5 years, a steady increase in most key figures, in line with FORNY's budget. The key figures also show a gradual increase in commercialisation activity as commercialisation becomes more integral part of research and as more funds are made available for commercialisation.[23]

21 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

22 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

23 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

1.3 HISTORY OF AND REASONING FOR FUNDING INSTRUMENT

The FORNY program is the most important instrument for stimulating the commercialisation of research results in Norway. FORNY, which stands for research-based innovation, was launched in 1995 and has been run continuously since then, from 2012 under the name FORNY2020. The FORNY program was started in 1995, following a pilot project in collaboration with NTNU the year before.

The purpose of the program was from the start to contribute to innovation and value creation in Norwegian business by strengthening the ability to commercialize research-based business ideas that arise in the universities and research institutions[24]. This was achieved by 1) establishing an infrastructure at institutions that could provide services in connection with commercialisation and help reduce barriers to commercialisation in the research communities, and 2) contribute to professionalization of the commercialisation process so as to increase in both the scope of commercialisation, as well as a qualitative improvement of the projects. Thus, program supported the companies responsible for the commercialisation process – so-called commercialisation actors (KA). Later, research institutes have established their own technology transfer offices, and these are the players who play the most important role in commercialisation.[25]

Initially, FORNY was organized in four regional programs, FORNY, Eastern Norway, FORNY Vestlandet, FORNY Midt-Norge and FORNY Nord-Norway respectively. From 2000, the activity was collected in one program and the objectives were specified in more detail. In addition, the need for interaction between FORNY and the other instrument of intervention 'so that the commercialisation processes get effective and far more comprehensive assistance' was pointed out at that time[26].

The FORNY program was evaluated in 2009 (Borlaug et al 2009), and the main conclusion was relatively critical. On the positive side, it was concluded that the program had reached the target group and triggered innovative and R & D-based projects. High commitment was reported among the entrepreneurs that had been supported through the program and a professional system of enthusiastic actors was developed.[27]

Nevertheless, the main picture was still critical. First, the TTOs did not succeed in bringing up many businesses, about 300 since the start of the program in 1996, among which there were very few growth companies, only three or four enterprises could be characterized as successes. The total turnover of the enterprises was approx-

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24 Bolkesjö et al 2004: Evaluering av kommersialiseringsenhetene i FORNY - programmet. Telemarksforskning-Bø, rapport 212 2004.
25 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.
26 Bolkesjö et al 2004: Evaluering av kommersialiseringsenhetene i FORNY - programmet. Telemarksforskning-Bø, rapport 212 2004.
27 Borlaud et al 2009. Between entrepreneurship and technology transfer: Evaluation of the FORNY-programme. NIFU STEP report 19/2009.

imately 900 million NOK and they had a total employment of around 700. But the median turnover for the companies was almost a million, and value creation and employment was close to zero. Moreover, although there could be many explanations for this, the evaluation concluded, "the strategies that have been followed so far by many of the TTOs have not been good since their resources have been significantly tied up in projects with limited exit opportunities. Consequently, the program should use more selective strategies in the future" (Borlaug et al. 2009, p. 72, our translation).[28]

The evaluation concluded that the work of commercialisation was not well rooted in research institutions, that the interaction with other instrumentation was not good enough and that the program had unclear goals. At the same time, however, it was also concluded that the program plays an important role in commercialisation and that there was a need to continue a program of this type.[29]

Based on the evaluation, a reorganization of the program was made which meant clarifying the goal of contributing to increased value creation and a demand for stricter selection processes. In the program plan, it was said: (Program plan FORNY2020 p. 2):

The projects will carry out targeted activities so that they become interesting as investment objects for national and international business, capital actors or the public sector. The projects will have a high potential and high expected commercial and societal returns. The program will work to ensure that projects that are particularly innovative and ahead of development are prioritized.

The objectives of the program were formulated with a main objective of increased value creation based on bringing research results from publicly funded research institutions to the market and two sub-goals for selection and support for projects with high expected commercial returns or other societal benefits, and stimulate the development of professional and effective commercialisation actors.[30]

Also since 2012, in addition to TTOs with basic funding under the FORNY2020 program, the following groups may also seek funding

- newly established microenterprises based on results and concepts generated at publicly-funded research institutions;
- other organizations that facilitate the commercialisation of results from publicly-funded research activities.[31]

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28 Borlaud et al 2009. Between entrepreneurship and technology transfer: Evaluation of the FORNY-programme. NIFU STEP report 19/2009.

29 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

30 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

31 Spilling et al 2015: Virkemiddelapparatet for kommersialisering av forskning – status og utfordringer - Sluttrapport fra evalueringen av virkemiddelapparatet for kommersialisering av offentlig finansiert forskning, NIFU rapport 18/2015.

2 DESCRIPTION OF FUNDING INSTRUMENT

2.1 TARGET AND FORMS OF FUNDING INSTRUMENT[32]

The FORNY2020 program offers three types of support:

1) Proof-of-concept funding

Commercialisation projects in an early phase often entail a higher level of risk than investors are willing to accept. It can be extremely challenging to find funding for testing a new concept, a new technology or a new prototype.

Proof-of concept funding under the FORNY2020 program is designed to facilitate activities aimed at the commercial application of results from publicly funded research.

Proof-of-concept activities may include

- clarifying application and market potential;
- testing a concept, technology or prototype;
- developing a business model;
- securing rights;
- establishing contact with customers and users.

Microenterprises and TTOs with basic funding under the FORNY2020 program are eligible to apply for proof-of-concept funding. A microenterprise is defined in this context as a company that was established less than six years ago at the time of submission of the grant application and that bases its activity on intellectual property generated at publicly funded research institutions.

2) Basic funding for TTOs

It is often a long, resource-intensive process to generate new ideas, establish projects and bring the results of these to the market in the form of products and services.

Basic funding for TTOs under the FORNY2020 program is a multi-year allocation of operating assets to ensure predictability in the TTOs' activities. The grant may cover up to 50 per cent of operating costs.

3) Funding for structural enhancement, network-building and competence-building

The FORNY2020 program seeks to foster better cooperation and integration between companies, research institutions and TTOs. TTOs may seek funding to improve cooperation and organizational structures, build networks and enhance internal expertise in relevant areas.

Support may be provided in the form of funding for

- restructuring, collaboration and specialization;
- competence-building program, gatherings of project managers, and activities to enhance the professionalism of management and development teams;
- network-building in domestic and international markets and vis-à-vis trade and industry and the finance community;
- mentoring schemes.

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32 FORNY2020 webpage, visited 18.10.2017.

In 2016, STUD-ENT was launched as a new form of support aimed at master's students wishing to invest in a career as entrepreneur. Student projects can apply for up to NOK 1 million to realize their business page based on the knowledge they have gained through the studies. By directly supporting the students, STUD-ENT is indirectly expected to stimulate increased innovation and entrepreneurship focus among the university and college sectors.

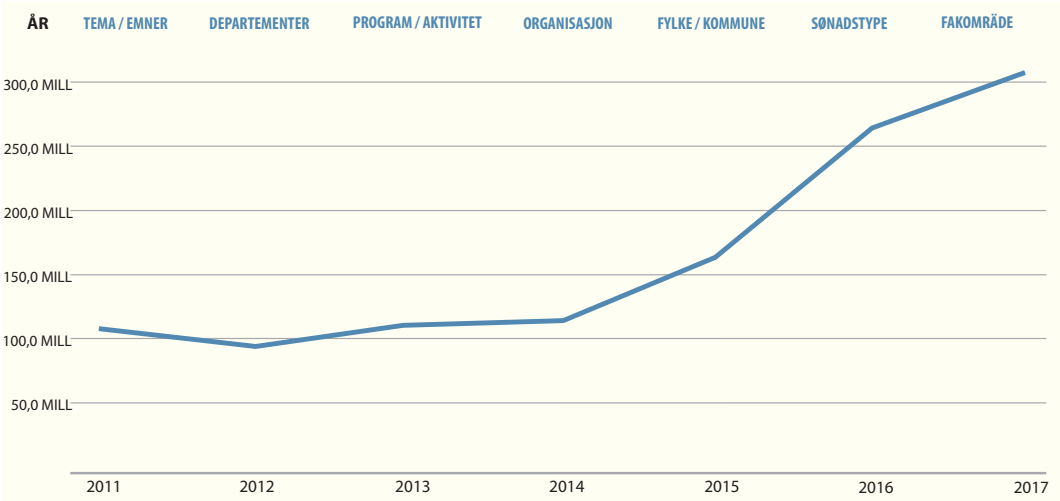
In 2016, the Research Council conducted two STUDENT-ENT announcements. The applications were generally of good quality and came from different fields of study, but when it comes to the link to the HEI's academic communities, it should be clarified.

2.2 FUNDING VOLUME AND TERMS

In the Figure 4 is presented the development of FORNY2020 funding. As seen from the figure, these is considerable increase in funding since 2014. The POC-funding makes up the largest portion of the budget in FORNY2020. Until 2014, there were one call for proposals for POC-funding, while in 2015 and onwards there were two calls for proposals. That also explains the increase in funding.

In 2014, there were a total of 96 million NOK for POC-funding, 56 applications were received, of which 34 best qualified were invited to present projects for the assessment panel and 23 projects were granted. Of these,

FIGURE 4. Development of FORNY2020 funding.[33]



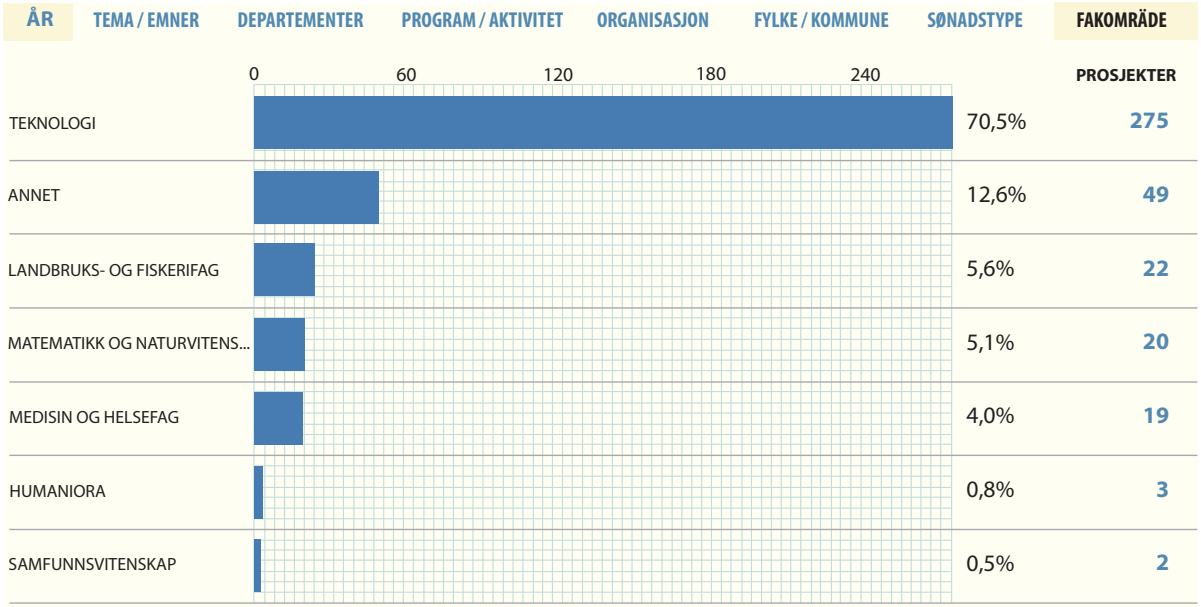
[33] FORNY2020 webpage, visited 18.10.2017.

20 projects are led by TTOs, while three are managed by micro enterprises.

In Figure 5 are presented FORNY2020 POC –projects by discipline. Most of the projects fall into category technology which covers many different technology areas ranging from ICT and material technology to biotechnology. In recent years, the number of biotechnology related projects have been in increasing and ICT related projects decreasing.

Information about the selection criteria for POC-projects can be found in Appendix.

FIGURE 5. FORNY2020 projects by disciplines.[34]



[34] FORNY2020 webpage, visited 18.10.2017.

TUTL BENCHMARKING CASE – UK

1 BACKGROUND AND CONTEXT

1.1 COMMERCIALISATION OF RESEARCH IN UK

United Kingdom is an outstanding performer when it comes to science base. It has more Nobel Laureates than any country outside USA. When it comes to innovation and commercialisation of research, the picture is a bit different.

With its large service-based economy, the United Kingdom performs below the OECD median on several headline indicators, including R&D expenditure and patenting. UK has a very open economy, and a relatively high proportion of BERD is accounted for by large foreign-owned firms (BERD composition). BERD is below the OECD average at around 1.07% of GDP (Performance index d in Figure 1). Almost half is accounted for by high-technology fields: pharmaceuticals (28%), aircraft and spacecraft (9%), and computer and software services (9%).[35]

Higher education sector expenditure on R&D rose substantially in real terms in the decade prior to the financial crisis of 2008/09. By 2009, the UK ranked a little above Germany, Japan, France, Korea and the US. It has, however, lagged in commitments to the sector in the aftermath of the financial crisis. After 2005, the UK lagged Germany, France, Norway, Korea, Denmark, Finland and Sweden in growth of the ratio of Higher Education R&D to GDP.[36]

Industry-financed public R&D expenditures as a share of GDP are below the OECD median (Index o in Figure 1). However, patents filed by universities and public labs per GDP is well above the OECD median (Index p in Figure 1), an indication of the commercial efforts made by UK universities.[37]

Hence, it can be argued that in terms of innovation outputs, the UK is not an outstanding performer. Innovation scoreboard rankings typically place the UK in a second group of 'innovation follower' nations behind leaders such as the USA, Japan, Switzerland, Korea and Germany. In terms of innovation inputs and, in particular, R&D in both the public and private sectors, the UK is also at the lower end of international performance.[38]

The closer look of research commercialisation outcomes presented in Table 1 shows that in relation to input (research resource) UK's performance is better than Japan's or USA's. Although different scoreboards indicate that UK is performing below average in innovation outputs, Table 1 suggests a different picture by presenting significant strengths of UK universities. Compared to the universities in USA and Japan, UK universities are

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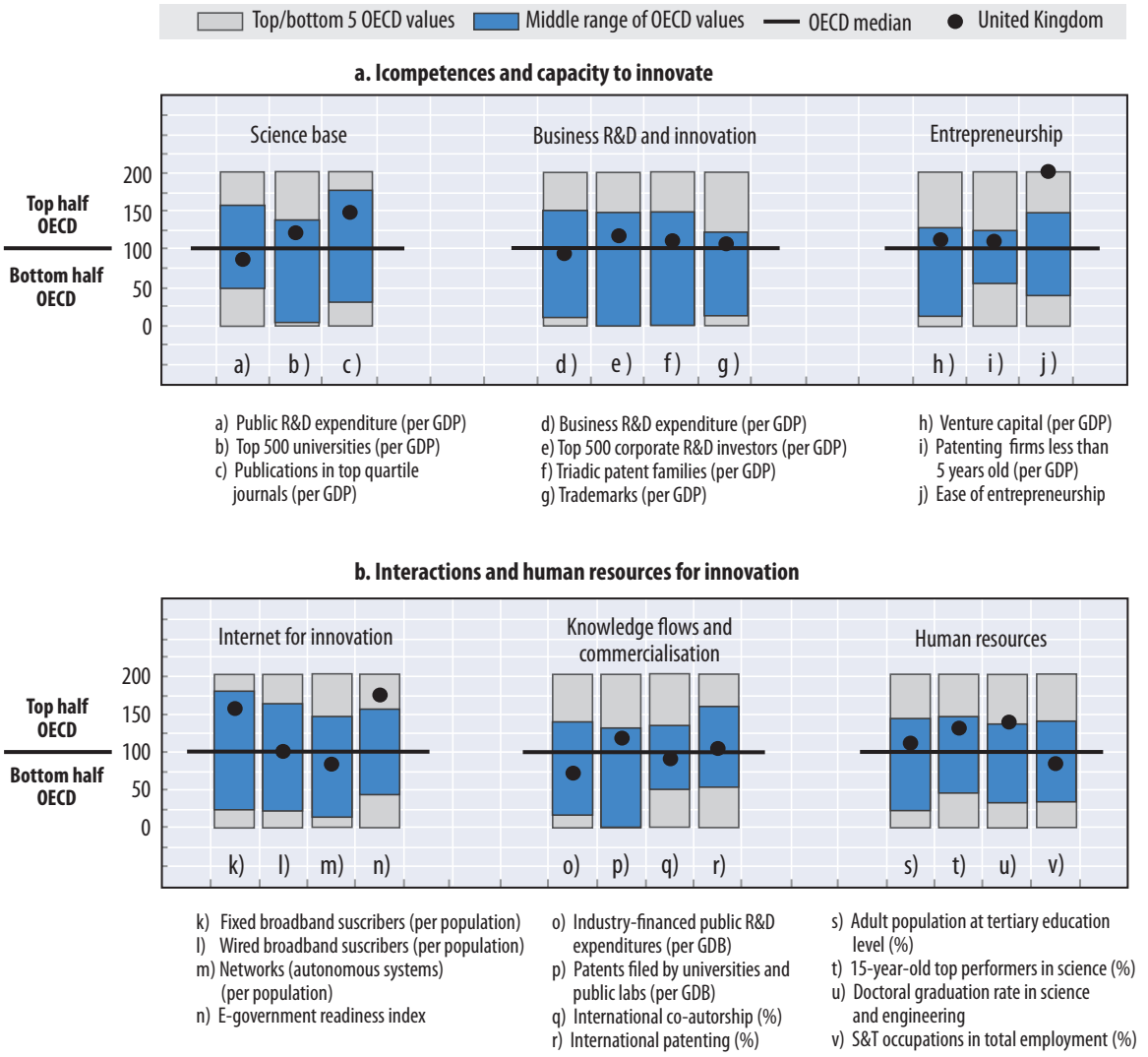
35 OECD STI outlook UK report, 2012.
36 The same
37 The same.
38 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.

FIGURE 1. STI performance in UK compared to OECD average. Source: OECD STI outlook UK report, 2012.



Note: Normalised index of performance relative to the values in the OECD area (index median = 100)

well connected to industry and they appear effective in IP processes, as well as spin-out formation.[39]

The UK R&D system is, however, dominated by a relatively small number of large universities whose performance has proportionally significant impact on the sector as whole, and by a relatively small number of large corporates that tend to dominate university industry collaborations.[40]

TABLE 1. Commercialisation activity 2013–14 – US, UK and Japan. Source: HEFCE: HE-BCI Survey report 2013–14.

	US AUTM	UK HEBCI SURVEY	JAPAN UNITT
Total research resource (£M)	35,722	7,043	14,715
IP income including sales of shares in spin-offs (£M)	1,290	131	18
IP income as % of total research resource	3.6%	1.9%	0.12%
Spin-off companies formed	747	147	18
Research resource per spin-off (£M)	48	48	817
Patents granted	5,163	976	4,776
Research resource per patent (£M)	7	7	3.1
Industrial contribution	2,330	508	64
% industrial research	6.5%	7.2%	0.4%
US cashed-in equity and UK Sale of spin-off shares (£M)	20	49	3.6
(Cashed-in equity and sale of spin-off shares) as a % total research resource	0.06%	0.7%	0.2%

1.2 ORGANIZATION AND RESULTS OF RESEARCH COMMERCIALISATION

Funding for university research in the UK is provided under the Dual Support System. The two components of this system are a 'backward looking' block grant from UK higher education funding councils (HEFCs). The Figure 2 presents to funding allocation of HEFCs in 2017–18 for various fields. A 'forward looking' element based on grant applications to the UK Research Councils.[41]

The first component is based on an assessment of past research quality across a pre-defined range of 'units of assessment' covering all subject areas. Universities get a block grant based on a formula using both numbers of researchers submitted and the assessed quality of their research and (since 2014) its impact beyond the strictly academic. Broadly speaking universities may allocate the block grant across their university research activities in any way they wish. It therefore provides universities with some strategic discretion in funding chosen areas of research.[42]

[39] HEFCE: HE-BCI Survey report 2013-14.
[40] Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
[41] Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015 and Guide to Funding 2017-18 by HEFCE, April 2017.
[42] Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.

FIGURE 2. Funding allocation of HEFCE 2017–18. Source: HEFCE Guide for funding 2017–18, April 2017.

The second component is a 'forward looking' element based on competitive bidding by researchers to Research Councils. In recent years, this bidding process has been redesigned to include specific consideration and identification of "Pathways to Impact" for the outputs of the research.[43]

The Dual Support System has in the past decade been augmented for UK universities by so- called 'third' stream support for knowledge exchange (KE) in the form of the Higher Education Innovation Fund (HEIF)[44]. This also takes the form of a block grant calculated on a formula basis that has changed over time and increasingly is focused on allocating support alongside research excellence.[45]

The main funding source for research commercialisation activities is KE funding from HEIF. In addition to research commercialisation or tech transfer activities KE funding covers activities like outreach, enabling small businesses to use specialist equipment and other facilities, delivery of professional training, consultancy and services, supporting graduates to set up their own business, and contributing to social innovation (see also Figure 3).

There exist also other funding sources for KE activities. These include the following:

- The Research Councils support a range of schemes for knowledge exchange to further the impact of their funded research.
- Innovate UK is the UK's main funder of business innovation.
- Universities and colleges play a significant role in local growth partnerships and can receive funding to support their knowledge exchange and skills activities, such as via European Structural and Investment Funds.

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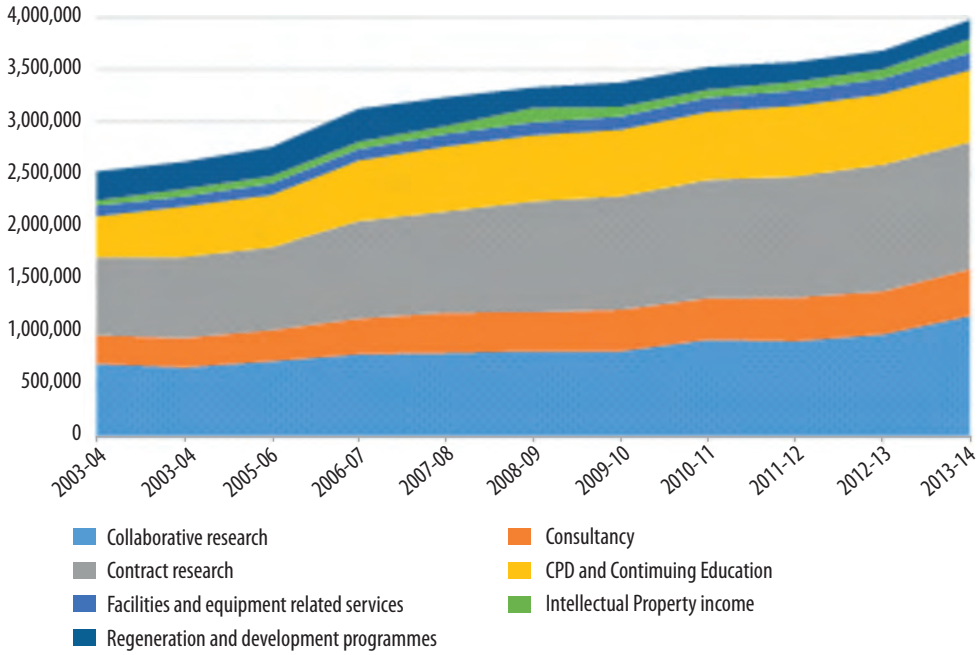
43 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
44 HEIF operates under HEFCE – Higher Education Funding Council for England
45 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.

- Funding from the beneficiaries of knowledge exchange in the economy and society provides a significant source of support to many institutions.[46]

FIGURE 3. Development of KE related income sources 2003–2014. Source: The MacMillan Group: University Knowledge Exchange (KE) Framework: good practice in technology transfer. Report to the UK higher education sector and HEFCE.



When it comes to results of KE activities, Figure 3 shows quite significant increase in income generated through these activities between 2003 and 2014. Especially incomes from collaborative research, contract research, consultancy, and CPD and continuing education have risen. Intellectual property income, which is usually seen as a result of tech transfer activities, has remained quite stable.

More precise picture of the results of tech transfer activities are provided by the survey related to university-business interaction. This survey covered tech transfer indicators from 2003 onwards.

Rapid increases in technology transfer indicators in the early years of HE-BCI (Higher education-business and community interaction survey) data collection (see table X) probably reflect improved reporting, and support given by the Science Budget for technology audits to appraise backlogs of potentially exploitable IP.[47]

Since 2008, technology transfer performance has been more variable. To some extend this reflects global economic conditions. The OECD has noted that the annual growth rate in patent applications by universities around the world fell from 11.8% to 1.3% between 2006 and 2010.[48]

One explanation can be that performance has varied because UK policy-makers and the UK university system have developed policies for KE that are more appropriate to our market conditions. Overall, KE income as meas-

46 Guide to Funding 2017-18 by HEFCE, April 2017.
47 The MacMilan Group: University Knowledge Exchange (KE) Framework: good practice in technology transfer. Report to the UK higher education sector and HEFCE. 2016.
48 The MacMilan Group: University Knowledge Exchange (KE) Framework: good practice in technology transfer. Report to the UK higher education sector and HEFCE. 2016.

TABLE 2. Trends in UK tech transfer. Source: The MacMillan Group: University Knowledge Exchange (KE) Framework: good practice in technology transfer. Report to the UK higher education sector and HEFCE. 2016.

£000S REAL TERMS ALL UK	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
License Income	39,412	44,625	50,068	47,202	51,789	62,713	62,589	64,850	71,459	76,478	82,058
Sale of spin-offs	9,278	25,796	19,540	21,145	23,666	75,377	27,936	8,410	10,814	11,877	49,059
Total	**48,690**	**70,421**	**69,608**	**68,347**	**75,455**	**138,090**	**90,525**	**73,260**	**82,273**	**88,355**	**131,117**
Specialist IP Costs	*18,975*	*19,278*	*20,309*	*24,101*	*23,911*	*30,864*	*31,793*	*33,078*	*32,905*	*34,564*	*34,177*
Patent applications	1,308	1,648	1,536	1,913	1,898	2,097	2,012	2,256	2,274	1,942	2,086
Patents granted	463	711	577	647	590	653	827	757	826	955	976
Formal spin-offs established	167	148	187	226	219	191	273	268	191	150	147
Formal spin-offs still active after three years	688	661	746	844	923	982	969	999	998	975	970

ured in the HE-BCI survey has risen to £4bn. This is in line with UK policy to pursue a wide range of routes to impact, to exploit a range of technologies, raise absorptive capacity and develop eco-systems.[49]

As a summary, it can be concluded that UK universities have increased their KE activity over time, but technology transfer has not grown as fast as other routes to impact. This is appropriate to characteristics of the UK economy and differentiation in university KE contributions, and hence features in UK KE policy. Technology transfer activity in the UK is fairly concentrated in a small number of universities.

1.3 HISTORY OF AND REASONING FOR FUNDING INSTRUMENT

HEFCE was established by the Further and Higher Education Act 1992. HEFCE is empowered to fund teaching, research and related activities of higher education institutions (HEIs), and prescribed courses of higher education at further education and sixth form colleges (FECs). The Higher Education Innovation Fund was established in 2002 to enhance linkages between HEIs and society.

Since the establishment of HEFCE UK government made series of innovation and other policy reviews. These focused on the apparent disparity between HEI ac-

[49] The MacMilan Group: University Knowledge Exchange (KE) Framework: good practice in technology transfer. Report to the UK higher education sector and HEFCE. 2016.

ademic performance and rising public sector funding for R&D on the one hand and weak private sector innovation performance and R&D on the other. Major reviews took place in 1998 and 2003 with further reviews in 2007, 2008 and 2011.[50]

As a result of the major review of innovation policy in 2003 (DTI, 2003) a new agency was created to deliver a rationalized set of innovation policy support instruments. This agency was known as the Technology Strategy Board (TSB) until 2014 when its name was changed to Innovate-UK. In 2004, following a major review of business/university collaboration, known as the *Lambert Review* the then Labour Government launched a ten-year Science and Innovation Investment Framework Policy. This Framework included a commitment to increase public sector R&D faster than the rate of GDP growth. The policy was designed to raise the overall ratio of UK R&D to GDP from 1.9% in 2004 to 2.5% in 2014. This assumed that the range of innovation support policies to be introduced would be associated with an increase in private sector R&D to match the increase planned for the public sector. This did not happen.[51]

In addition to these significant changes in the delivery and long-term nature of innovation policy support, there were other important changes. These were designed to increase university-industry collaboration and strengthen the research base through changing the funding structure for university research and commercialisation activities. One of these major changes is the establishment of HEIF and introduction of KE funding scheme in 2002.[52]

2 DESCRIPTION OF FUNDING INSTRUMENT

2.1 TARGET AND FORMS OF FUNDING INSTRUMENT

The knowledge exchange (KE) funding as part of the funding of Higher Education Funding Council for England (HEFCE) is provided through Higher Education Innovation Fund (HEIF).

"HEIF's primary focus will remain the support of knowledge exchange activities with all forms of external partners – businesses, public and third sectors, community bodies and the wider public – to achieve maximum economic and social impact for this country."[53]

The Higher Education Innovation Fund is frequently referred to as third stream funding. The term reflects the fact that the flow of funds to universities from this source is seen to be in addition to the two core elements of the dual funding structure for UK universities. The dual streams are respectively quality related research funding by the Higher Education Funding Councils after period-

50 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
51 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
52 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
53 HEFCE: Higher Education Innovation Funding 2011-12 to 2014-15: Policy, final allocations and request for institutional strategies, request for information May 2011/15.

ic research excellence framework exercises and funding through open bidding for Research Council projects.[54]

An important part of the evolution of the HEIF Programme since its introduction in 2002/3 was the replacement of earlier annual competitions by formula-based allocations stretching over several years of each HEIF planning period. This ensured that universities became able to offer posts associated with the support and development of KE activities over longer periods of time and on a sustained professional development basis than was apparent in the early stages of annual competitions. In addition, the introduction of formula funding has also allowed the scheme to be adjusted in broad terms to reflect changes in the direction of support which government may wish to make over time.[55]

Recent changes in the HEIF Programme related to introduction of a new approach from 2017–18 onwards, with annual re- calculations of allocations based on the latest data to increase dynamism and to reward recent performance, but also providing some predictability. Predictability is achieved by moderating year-on-year changes, which provides HEIs with a planning assumption to use in drawing up their five-year knowledge exchange strategies, and will apply for the period of the strategies.[56]

2.2 FUNDING VOLUME AND TERMS

Before establishing HEIF, the KE related funding was provided from other HEFCE sources, and was fragmented to different funding schemes. As Figure 4 shows starting from the establishment of HEIF in 2002, the main funding source for KE activities has been HEIF.

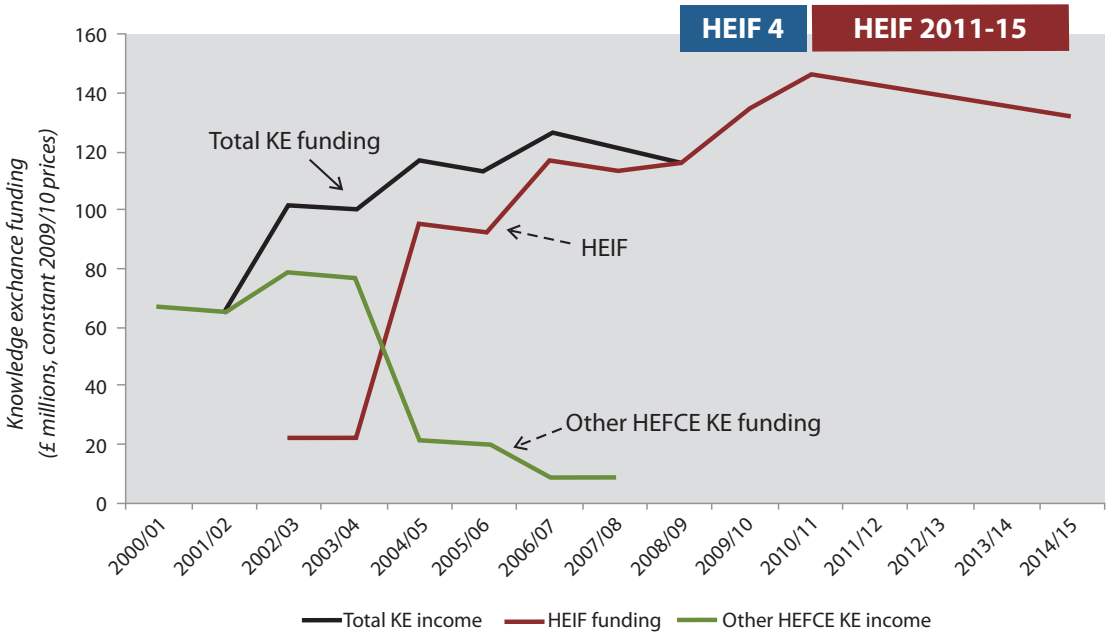
The UK Government emphasized its commitment to knowledge exchange in the 2010 Comprehensive Spending Review. HEIF funding was maintained in cash terms at the same level as the final year of HEIF 4, at £150 million per annum, pumping £601 million (in cash terms) into the sector for KE over the period 2011–15.[57] In 2017–18, the funding volume is £160.[58]

The key features of main allocation method for KE are the following:

- All funding is allocated based on performance, using a combination of measures of income as a proxy for impact on the economy and society. This aims to achieve the greatest impact from public funding of knowledge exchange. Income over a three-year period is taken account, weighted towards the latest year of performance. Income from small and medium-

54 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
55 Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.
56 Guide to Funding by HEFCE, April 2017.
57 HEFCE: Higher Education Innovation Funding 2011-12 to 2014-15: Policy, final allo-cations and request for institutional strategies, request for information May 2011/15.
58 Guide to Funding by HEFCE, April 2017.

FIGURE 4. KE funding development. Source: PACEC: Strengthening the Contribution of English Higher Education Institutions to the Innovation System: Knowledge Exchange and HEIF Funding. A report for HEFCE. 2012.



Note: The Funding data has been deflated using the GDSP deflator provided by HM Treasury. However, over half of HEIF funding is spent on supporting the wage bill for dedicated KE staff. Given this, the expected refuction in HEIF funding in real terms over the next period may be less severe if wage inflation is capped below price inflation.
Source; HEFCE, PACEC analysis

sized enterprises is given a double weighting within this component, to signal the importance of working with such businesses and to recognise the higher costs involved.

- There is an allocation threshold for all HEIs. Institutions that do not achieve an allocation of at least £250,000 per year through the formula do not receive an allocation. This is intended to ensure that our funding for knowledge exchange is efficient, through being targeted at institutions with significant knowledge exchange performance and partnerships.
- There is a cap of £2.85 million on individual allocations.
- Year-on-year changes to allocations are moderated so that, subject to being above the minimum £250,000 threshold, and below the £2.85 million cap, no institution has a change of more than £10 per cent compared to their previous year allocation.[59]

Additional funding of £100 million, to incentivise collaboration between universities in research commercialisation to contribute to the delivery of the Government's Industrial Strategy, is to be allocated up to 2021.[60]

See more about funding allocations and formulas used http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/2016/201616/HEFCE2016_16_.pdf

[59] Guide to Funding by HEFCE, April 2017.
[60] Guide to Funding by HEFCE, April 2017.

3 EVALUATIONS

A major evaluation of HEIF was published in 2009. The emphasis in the evaluation was on the role of third stream policies such as HEIF as mechanisms to develop activities spanning the boundary between HEIs and external organizations. These external organizations were interpreted widely to include the public, private and voluntary sectors.

The evaluation report argued that third stream funding schemes such as HEIF should in principle be an important part of UK's KE system. This is because they can address a number of 'systems failure' problems including;

- cultural inhibitions and lock-in problems arising from traditional HEI norms and practices, which may impede or hamper the process of knowledge exchange
- under-investment by HEIs in their capacity and capability to engage in knowledge exchange, because of: – inability of the knowledge base to sustain in-house offices – difficulties in securing an acceptable share of any benefit – cultural constraints
- limits on the ability of the innovation system to adapt to technological and
- other changes in terms of:
  - the underlying cultural norms which govern the incentives for individuals (on the supply and demand side) to engage in knowledge exchange
  - changing patterns of behaviour and the rules or norms of HEIs and external organisations affecting their interaction (openness versus secrecy)
  - the increasing role of HEIs in the commercialisation of scientific advances
- limited linkages, networking and collaboration by HEIs and other economic and societal agents, reducing the potential contribution of HEIs to the innovation process limited financial benefits from engagement with society and the wider community, leading to potentially low levels of knowledge diffusion with these groups.[61]

[61] Alan Hughes: Securing Australia's Future - Project 9. Translating research for economic and social benefit: country comparisons United Kingdom. 2015.

APPENDIX 2. CASE STUDIES OF FINNISH RESEARCH ORGANIZATIONS

CASE VTT TECHNICAL RESEARCH CENTRE OF FINLAND LTD

COMMERCIALISATION OF RESEARCH RESULTS AT VTT

VTT Technical Research Centre of Finland Ltd holds a special position among Finnish research organizations with respect to the commercialisation of research results. The core characteristic of all VTT operations is a close collaboration with industry and technology transfer. This is also demonstrated by VTT being the most active user of TUTL funding with 151 applications and 84 projects over the period 2012–2017/6. Total TUTL volume that VTT has received has been 23 m€, 18% of TUTL funding.

VTT has gone through significant organizational changes over the last years. In 2015, the legal status of VTT was changed from a government research institute into a not-for-profit, fully state-owned limited company performing specific services. The organizational structure has also been changed. The commercialisation processes are well organized and the resources allocated to the commercialisation of research are more substantial than in any other research organization in Finland.

At the moment, the VTT research is organized into three business areas: Knowledge Intensive Products and Services (KIPS), Smart Industry and Energy Services, and Solutions for Natural Resources and Environment. Each business area is led by a leadership team, which is headed by EVP. Other leadership team members include VPs of different research areas as well as a VP of research and VP of sales and business development. Commercialisation activities in each business area are led by VP of sales and business development and supported by a team of 3 - 5 business development managers and specialists. These persons work with all business development activities linking research and industry including, e.g., TUTL project preparation and implementation support. It is also noteworthy that industry collaboration is managed by separate key account managers for industry clients. At the moment, there are about 10 key account managers within each business area. In addition to the commercialisation staff in each business area, there is a crosscutting IPR team and IPR manager responsible for IPR management and licensing. In total it can be estimated that about 50–60 persons across VTT work directly with the commercialisation of research results. An important addition to the system is also VTT Ventures Ltd, which invests in new VTT originated ventures at the seed phase.

VTT has developed clear internal processes for the project "pipeline". Project ideas and suggestions emerge from the whole organization. The realization of any research project is subject to the research management's approval. In addition, TUTL project development has its own special rules and always requires the approval of VP of sales and business development. TUTL project proposals are also assessed by business development managers and by the IPR committee of each business area before they can proceed to the project preparation and application phase.

STRATEGIC RELEVANCE OF TUTL

VTT's profile differs from the universities in that the commercialisation of research results is at the core of the organization's strategy. During the last years, this has been further emphasized in the strategy. Within VTT, there are alternative commercialisation paths that partly also compete with one another. TUTL has been highly relevant for VTT and this is mirrored in the level of activity and success that VTT has had with TUTL. In the beginning of the TUTL period, VTT very actively collected potential ideas from the whole organization. On average, annually, more than 20 project applications have been submitted and on average around 10 projects have been realized with TUTL funding. Although the commercialisation path leading to spin offs is still important, the organization is today much more selective with the projects that are supported on this path. When previously the number of new spinoff companies per year was around 2–3, today there is perhaps one new spin off company established per year. The volume of TUTL projects is also becoming smaller (3 new projects in 2016). The reason for this is that commercialisation by spin offs is the preferred path within TUTL, while other ways of commercialisation in direct collaboration with the industry are becoming more important for VTT. Another challenge is that the teams involved in TUTL projects are committed to that work (Tekes preference for TUTL projects include an expectation that the team is 100% committed to the project) and that the results cannot be used at the same time within other industry assignments.

CHALLENGES AND BEST PRACTICES

Resources and efficient processes. VTT has allocated appropriate resources and has developed clear processes for commercialisation. A sufficient volume of project ideas has enabled VTT to invest in developing their processes, and efficient processes result in better quality projects. As it takes time and resources to develop efficient commercialisation processes, many other organizations in Finland are not at the same maturity level as VTT. These organizations would need more external support for thorough due diligence of their project ideas.

Business areas differ. The three VTT business areas differ greatly in their TUTL activity. Most of the projects and spin offs have been coming from the KIPS area, some from the Solutions for Natural Resources and

Environment whereas the Smart Industry and Energy Services business area focuses more on direct industry collaboration through commissioned research. In the KIPS area there are much more patents emerging, the investment requirements for spin offs are smaller compared to e.g., bioeconomy related business ideas and the time required for business development is shorter. As an instrument, TUTL should be developed to better take into account the specific characteristics of different industries.

Cooperation with universities. During the first TUTL years, VTT was active in initiating cooperation with universities. VTT together with Aalto were the first to establish joint pitching of ideas to Tekes. The cooperation between VTT, Aalto University and Tampere Technical University is still active. Generally, cooperation is perceived as a positive thing, but it can also have complications for the project work particularly with the IPR issues.

Finding the team. Finding the right team is the most important prerequisite for success. Even less good ideas can succeed if the team is brilliant. VTT has over time developed very good networks for finding the right people from outside. This is the result of long-term development and it requires continuous work. The main challenges in building good teams are related to internal issues. Devoting the time of top researchers to TUTL projects is away from research and other industry collaboration.

SUCCESSFUL CASE EXAMPLE

Dispelix (www.dispelix.com) has a technology to prepare smart glasses that look like normal eye wear. Dispelix's optical see-through near-to-the-eye technology utilizes a lens-like light guide for transferring the virtual image into the user's field of view. The company has a focused product that is easy to scale up and which benefits of the Augmented Reality growth markets. The company got seed financing from Lifeline Ventures and VTT Ventures in 2016. In 2017, the company was listed among the 50 most promising start-ups in the world on Bloomberg's list that scanned over 50 000 start-ups in the world.

CASE TAMPERE UNIVERSITY OF TECHNOLOGY

COMMERCIALISATION OF RESEARCH RESULTS AT TUT

In Tampere University of Technology (TUT) the wide-ranging cooperation between the University and business life gives rise to several new companies and substantial new business in existing companies every year. Nearly half of the inventions (appr. 70 invention disclosures per year) made at TUT are transferred to companies that use them in their own business and patenting. TUT has also been quite active in applying TUTL funding. Between 2012–2017, it has had over 100 TUTL applicants and 38 funded projects.

At the moment TUT is in the merging process with University of Tampere (UTA) and Tampere University of Applied Sciences. The new university will start its operations in 2019. At the moment TUT has five faculties: natural sciences, engineering sciences, business and built environment, computing and electrical engineering and biomedical sciences and engineering. The latter one collaborates with University of Tampere through the BioMediTech Institute, bringing together experts from many different disciplines of biosciences and biomedical engineering.

The commercialisation activities at TUT are centralized to Innovation services unit with exception of BioMediTech which has its own commercialisation services for both TUT and UTA researchers working for the institute. TUT's Innovation services has a team of 5 experts. The team takes care not only commercialisation activities but also identifying and protecting IP, managing inventions, entrepreneurship activation, students, researchers and other staff members, related activities. TUT has a systematic internal process for the potential commercialisation projects. The process starts from filling the invention disclosure when appropriate. Researchers are encouraged to do that, and supported in their process of utilizing research results. TUTL funding is seen as a key funding tool for the commercialisation project stage. Innovation services are the key drivers in the application phase, faculty representatives can participate.

The BioMediTech institute was originally established in order to enhance the utilization of research results generated from the fields of biosciences and biomedical engineering. In these fields, the research and commercialisation processes are long, and require special expertise. In BioMediTech the commercialisation team consists of three persons with expertise in areas of patenting, IPR and commercialisation. BioMediTech has a framework for commercialisation process, but the process is tailored for the needs of each specific case. TUTL funding is utilized in appr. 3 cases per year. BioMediTech participates to a pilot[62], in which SPARK model[63] originating from Stanford University, is tested. In SPARK, process starts when the idea is generated, and

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62 Pilot is partly funded by the Ministry of Economy and Employment. University of Helsinki and Aalto University are also participating to the pilot.
63 See more https://sparkfinland.fi/contact/.

SPARK helps the idea owner to increase the maturity of the idea by bringing an international expert team to support the process. The expert team works on probono basis. The initial experiences from the model have been encouraging,

RELEVANCE OF TUTL

TUTL has a strong culture for collaborating with companies, and a natural way for collaboration are common research projects. Thus, the number of inventions transferred to companies on annual basis is higher than the number of TUTL applications or TUTL projects. In the larger picture utilization of research results is seen much wider activity than creating spin-offs or licensing technologies. But for the purposes spin-off creation and licensing, TUTL is main available funding tool, as TUT has no funding mechanism for the initial phases or phases following TUTL funding. In cases TUTL has proved to be too slow and "massive" funding source, and funding for these cases has come from various other funding sources.

TUTL funding is important also from the point of view that it shows to the University management the importance of the commercialisation activities. Nowadays spin-off and start-up creation are part of TUT's strategy, and since TUTL funding started also the resource allocations to Innovation services have increased.

CHALLENGES AND BEST PRACTICES

Before, after and during TUTL. TUTL funding concentrates on so-called proof-of-concept –phase of commercialisation process. The former TULI-funding consisted of smaller studies related to commercialisation readiness and potential. External funding for these is now missing, but is seen as important phase before TUTL. Some minor funding is available from Innovation services; however, this funding does not scale. Similar manner these exists a gap after TUTL funding and available other funding sources. TUTL funding in turn is usually for two years, and quite extensive, which may motivate researchers to devote part of the funding for research type activities. Solution could be a funding model which divided into different phases and which more closely follows the progress of commercialisation.

Organization of activities in national level. As Finland is a small country with limited resources, and as our competition, both in research and business, is global, collaboration and even organization of activities on national level is important. As TUT is middle-sized university with many different disciplines, investing in having top commercialisation expertise in every discipline or business area is not feasible. A SPARK type of model in national level for all relevant business areas, could bring the top expertise for the potential cases.

Importance of early support. Utilization of research results takes place in many different forms. For a researcher who gets an idea, the way of or path to utilization is unclear and even irrelevant. However, in order to be able to fully utilize the results, it is important that researcher be given the relevant support for utilization. That way it is ensured that for example that background materials or publication of research results will not hinder commercialisation.

Utilization of research results is much more than commercialisation or TUTL. "Funding always improves hearing" meaning that investments are made to the areas where funding is available. TUTL funding has focused the attention to spin-off creation and licensing as form of utilization, it has also steered attention and resources to those activities. As other forms of utilization do not have their specific funding tools, it is not easy to have resources allocated for those activities.

SUCCESSFUL CASE EXAMPLES

Askel Healthcare's COPLA Scaffold™ is a 3D biodegradable composite of polylactide and non-animal derived collagen for cartilage repair in weight bearing joints. The COPLA Scaffold™ can be used in different cartilage locations, in different species, and for full thickness chondral or osteochondral lesions. The COPLA Scaffold™ is only available for animal healthcare. Askel Healthcare has gained TUTL funding two times, won in SLUSH in 2015 and started sales autumn 2017. Read more http://askelhealthcare.com/.

Ampliconyx is founded in 2016 as spin-off from Optoelectronics Research Centre of Tampere University of Technology – the home of Finland's photonics industry. The company commercializes technology of active tapered double clad fibers (T-DCF) invented, patented and implemented by Dr. Valery Filippov and Prof. Yuri Chamorovski as a result of decade of research. Read more http://ampliconyx.com/.

ColloidTek Oy founders and key personnel have a long history in scientific research of liquids in Tampere University of Technology. ColloidTek develops and commercializes the patented Collo technology for various fields of business. Collo revolutionizes process analyzes by bringing online measurements where they have not been possible before, for example to very thick liquids. Collo has its own patented digital analyzing system that is unique of its kind. The system measures process liquids constantly in process line (in situ) and gives data for adjustments without delay. Read more https://www.colloidtek.fi/.

FORCIOT® is a Finnish technology company that was born in December 2015. Group of leading wearable researchers from Tampere University of Technology and consumer electronics experts agreed to put their expertise together in developing new innovation that would start a new era in wearable business. In FORCIOT®, the sensor technology measures the performance and the cloud application software reports and stores the result for the user. Read more http://www.forciot.com/.

CASE SAIMIA UNIVERSITY OF APPLIED SCIENCES

ROLE AND PROCESS OF RDI COMMERCIALISATION

The strategic focus and support for commercialisation from organization leadership has been clear and strong in Saimia during recent years. The commercialisation of innovations is one of the three strategic goals of Saimia's current and previous strategy. Saimia's role in commercialisation is to configurate technical structures of the inventive / research-based ideas to first proof of concept production version. Precommercial measures have been at the core of Saimia's activities (market analysis, competitor analysis etc.). Commercialisation of RDI has been for a longer period of time at the center of Saimia's strategies and this emphasis was further strengthened, when Saimia moved to Skinnarila Campus right next to where Lappeenranta University of Technology (LUT) is located. In the future Saimia and LUT will continue even closer cooperation. From January 2018, Saimia will become a part of the LUT corporate group and Saimia's name will change to Saimaan ammattikorkeakoulu.

In addition, at Skinnarila campus, a start-up accelerator unit has been founded. At the Green Campus Open Business accelerator unit, both Saimia's and LUT's experts are working together with the researchers. The Green Campus Open supports in the preparation of business plans and generates deal flow for the Green Campus Innovations and other investors. The Green Campus Innovations also makes pre-seed and seed equity investment. Previously there was also an "invention agent", who retired. A new invention agent has not been hired to replace the old one. Business accelerator unit supports and promotes the commercialisation of research-based inventions to businesses and supports the business development of regions technology -companies.

THE COMMERCIALISATION PROCESS OF SAIMIA UNIVERSITY OF APPLIED SCIENCE

Saimia and LUT collaborate strongly in RDI commercialisation. They have a joint process for RDI commercialisation where Green Campus open start up accelerator unit works closely with Green Campus Innovation Investment Company and with City of Lappeenranta's business and city development unit[64]. Part on the process was pictured in Innovation Scout -project, which was developing a bridge model from TUTL-projects to venture capital markets. The commercialisation process was pictured also as part of Saimia university of Applied Science quality auditing. This has been important in clarifying processes and goals to different actors in Saimia.

The staff of Green Campus make sure that the inventions created in Skinnarila campus are developed under the same process. Accelerator unit helps to develop the business plans and supports with matters related to IPR. The role of the Green Campus Innovation Investment Company is to search for investors and also to make

[64] https://www.lut.fi/yhteistyo-ja-palvelut/kasvua-yrityksille/innovaatiopalvelut

small own investments. For the purpose of commercialisation, a continuing development process has been set up and networking service organized.

BRIDGING RESEARCH AND BUSINESS

During the recent years Saimia has grown volumes of innovation activity. Saimia is the only University of Applied Science, whose funding from Tekes has increased. Before TUTL, Saimia had projects for example in Tekes' Groove programme. All of the Tekes' TUTL projects have been joint projects with Saimia and LUT.

Saimia has had several projects aiming at the commercialisation of research results, during the recent years. Saimia has organized eight TUTL-projects, one Tekes/EAKR-funded commercialisation project and one Tekes/Groove funded project. Examples of Tekes' TUTL and other projects are: Business Utilizing Sustainable Integration of Novel Energy Systems (DRIVE!), Kuitupohjaisten pakkausratkaisujen valmistusmenetelmien kaupallistaminen (FIPATEK), Hermeettinen turbogeneraattori yhdyskuntien sivuainevirtojen, biomassan tai hukkalämmön energian muuttaminen sähköksi (HERGE), Hybrid Powertrain Dimensioning and Manufacturing (HyPDiM), An Infinitely Variable Differential (IVD), Suora nestejäähdytysratkaisu sähkömoottoreihin (KOOLER), KINO ja LaserKond[65].

GOOD PRACTICES AND CHALLENGES

Best practices: The most significant best practise is the close cooperation between LUT's scientific research and practical scientific R&D&I -work done by Saimia. Small University of Applied Science and small University are supplementing each other this way by working in close connection in the same campus. It has been noted as an important factor that people from both organizations meet each other more often this way and new ideas will rise by the conversations (in common coffee rooms and dining areas). In addition, a good practice is that the TUTL-projects have been joined projects with Saimia and LUT. Emphasis is placed in getting both technology experts and commercialisation experts to projects.

Good practise is also that Green Campus Open start up accelerator units support continues after TUTL project has ended and after the creation of a new spin off. The goal is to have an accompanied transfer from research to business after TUTL ends. Green Campus Innovation Company supports in getting the needed equity to start the new businesses. Getting Initial Seed Capital has proven to be relatively easy.

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65 https://www.saimia.fi/fi-FI/tki/innovaatioista-liiketoimintaa

Challenges are connected to the fact that project implementers are working simultaneously as a researcher and entrepreneur. It is common, that in Finland technology research is done because of interest in tech development, and not because of commercializing technology. Commercialisation has not been taught to researchers and the technology value for consumer is not recognized as part of the research widely enough. There is a lack of know how in research organizations of technology marketing and selling.

When decisions should be made on commercialisation, many researchers aren't ready for it. Researcher are not entrepreneurs from deep down. It has been recognized that even though it is easy to get seed funding, the path after that, is usually very hard. Quite often, the research teams does not include anyone willing to take these chances.

If the researchers move on to become an entrepreneur he will also leave the academic surroundings and valuable know how is not at the use of University anymore. Also, the surrounding businesses that acquire research IPR, can lure these scientists away from the academic world. This is a challenge for the university because valuable know how isn't available anymore at the university. After these scientists leave, one challenge is how to get researchers back to the university when they leave the business world.

THE ROLE AND SIGNIFICANCE OF TEKES (TULI, TUTL, INNOVATIONSCOUT) FOR SUPPORTING THE COMMERCIALISATION OF RESEARCH RESULTS

The role of Tekes is much more than just a financier. Tekes advices actively the researchers and especially during project implementations Tekes steering groups are considered especially important at times, when there are multiple projects going on at the same time. Tekes also encourages researchers to apply for funding, which is very important.

The RDI commercialisation instruments of Tekes have been very important modes of funding for Saimia. With the same volume, other instruments haven't been used by Saimia. Smaller instruments have been used mostly for raising the knowledge of research results. The timing of TUTL and Innovation Scout has also been right from Saimia's point of view and for the preparation of joining the LUT corporate group. Innovation Scout and the preceding KINO have been used to develop commercialisation process which is based on the experiences received from TUTL-projects.

The challenge is that Tekes' organization has changed many times during the last years. This becomes apparent in the lack of continuity in application processes.

For researchers and companies, the continuity from one instrument to other is crucial. If the knowledge doesn't exist of the continuity and following possibilities from one instrument, there will be problems in creating longer commercialisation process. Especially the uncertainty of the continuation of instrument is challenging. More time is needed to get ready for instrument changes.

The commercialisation of industrial products is more difficult than for example the products from gaming industry, where the innovation is immaterial themselves. A physical device requires more time and resources than a software. When the financier has the same instrument for different industrial sectors, it becomes challenging to compare the resources needed for commercialisation in different sectors.

Tekes has not enough funding for semi-commercial proof of concept and getting a prototype. Manufacturing one industrial device can be challenging, because it consists of several components. First functional version is indispensable. Potential client will not start to negotiate before he/she sees the device actually works. To get to this stage funding has to be applied from Teknologiateollisuusliitto ry e.g. In Germany, for example, the industry participates by donating devices and offers possibility to use laboratories to these kinds of projects.

The uncertainty of TUTL-funding and Business Finland's funding in the future, influences how much Saimia will invest its own resources. Investments to staff are risks, if one doesn't know whether outside funding will be available in the future. For research organizations it is very important to get information as soon as possible, whether funding is available or not in the coming years.

SUCCESSFUL CASE EXAMPLE

DRIVE! project (Räätälöidyt ja integroidut ratkaisut liikkuvien työkoneiden sähköiseen voimansiirtoon)

The DRIVE! project shows that the long-term funding continuum has been necessary for commercialisation of RDI. The project has succeeded in creating a start-up company. The Tekes TUTL funding (2014–2016) was preceded by funding by EU (2012) and Technology Industries of Finland (2013). The inventions were created during the period funded by both the Technology Industries of Finland and Tekes. After the DRIVE! project, a startup company was established. Tekes is funding the startup company to scale up the business.

Drive! projects (2014–2016) process stages as an example of a successful Saimia and LUT project.

TIMING	PROCESS STAGES
2012	EU-funded projects preceded DRIVE! -project in 2012. EU project included preparatory measures for TUTL project
2013	After EU-project Teknologiateollisuus ry funded a continuation project 2013 where the idea was taken further. As a result of the project invention disclosure was done of the idea. After the project a patent application was done before TUTL-stage. More inventions related to original idea was created and used in TUTL -project.
2014–2016	Tekes' TUTL-project DRIVE!
2016–	Tekes funding for startup-company. DRIVE!-projects startup-company launches its operations. Tekes funding used to start operations 3 persons hired Green Campus Open accelerator unit continues support until the company gets pass the "valley of death".

CASE HELSINKI INNOVATION SERVICES AT THE UNIVERSITY OF HELSINKI

Helsinki Innovation Services (HIS) is a company owned by t University of Helsinki (UH). HIS is responsible for the commercialisation of IP created in research conducted at University of Helsinki. HIS identifies and evaluates commercially viable research results and aims at developing them as profitable start-ups or out-licensing opportunities. HIS started in 2011.

COMMERCIALISATION OF RESEARCH RESULTS IN UH AND COMMERCIALIZING PROCESS IN HIS

HIS has developed a process for the commercialisation of research results using TUTL, which progresses step by step in co-operation with Tekes. Lots of influences to this process have been taken especially from foreign universities especially in the UK and the process has been recognized as progressive and distinctive one in Finland. Innovation Scout -projects have been important factor in the creation of this process.

The commercialisation process starts when a research group in the UH approaches HIS and completes an invention disclosure (about 100 per year). After this, HIS evaluates the commercial potential of the invention. If commercial potential exists, HIS decides whether the related rights of the invention belong to the researcher(s) or to the University. In case the University owns the rights to the invention, HIS begins to promote it and makes an agreement with the research team at stake.

At the second stage the invention will be protected, if possible, by preparing a patent application, which is done in collaboration with HIS and the research team. HIS coordinates this stage of the process.

At the third stage Tekes TUTL funding is used to increase the value of the invention and to refine and adjust it to meet the market demands. The University of Helsinki has its own process for preparing TUTL applications, HIS providing assistance to the research team. The assistance consists of an introductory part to TUTL, preparing a project plan and an application (approach, benefit, competition, budget, project team) and rehearsing pitching the project idea to Tekes. After this, if the application is accepted, TUTL project starts (there are in average 15 on-going TUTL projects at the UH). HIS acts as a commercial consultant responsible for the commercialisation part in TUTL projects. HIS role is particularly important in finding the right partners and especially in gathering the right team for the commercialisation. HIS also scans the right financiers to further enhance the commercialisation process, using its networks in Finland and abroad.

The fourth stage includes entering the markets, which takes a form of licencing to business partner or a new spin-out company. In case of licencing, the compensation offered to the licence provider (the University) is determined in a separate licence agreement. In case of spin-outs, the project results are taken to CAB (Commer-

cial Association Board) at the UH for evaluation. The board evaluates, which research results are suitable for spin-offs. If the research result receives the CAB approval, University of Helsinki funds will be used to grant capital loan of usually 50 000 euros to further commercialize the idea and Tekes funds will also be applied.

Altogether, some 10–12 companies have been created based on TUTL-projects during the last couple of years. This is a good track record, since, for example in Oxford University, the same number per year is 6 companies in average.

ROLE AND IMPORTANCE OF COMMERCIALISATION AT THE UNIVERSITY OF HELSINKI

Commercialisation of research results has become strategically more important at the University of Helsinki during the last years and more emphasis has been placed on the matter. Substantial investments provided by the University have been made to create the right operating conditions. The formation of HIS is the most important event in this case. Processes have also been developed and more resources directed to commercialisation. This has enabled the recruitment of skilled experts for HIS, which is a key factor for the HIS success. Special attention is also paid to the effectiveness of commercialisation activities, using monetary incentives. At the same time, the management at the University has been strongly committed to commercialisation activity by raising the issue to the front.

KEY ASPECTS OF HIS COMMERCIALISATION PROCESS

Commercialisation process at the University of Helsinki and HIS is one of the best organised in Finland. The most important underlying factor to this are the resources directed to fund the separate commercialisation unit that acts as a part of the University. This enables the full support to the commercialisation process of research results, sufficient guidance to researchers and support in finding the right partners through HIS networks.

Another key aspect is the successful gathering of a qualified team of experts to HIS. Attention is also paid to directing the right experts in HIS to right commercialisation projects. Personnel need to have top commercialisation skills, experience in start-up scene and knowledge as well as the ability to profoundly understand the research ideas of different sciences. The personnel need to work closely between the scientists and with investors that are potentially interested of the research results. HIS personnel need to understand both mindsets and way of thinking.

Important part of the success of commercialisation includes also the efforts to gather the right external investors and experts to commercialize the research ideas after TUTL. Special attention is paid to provide teams with sufficient scientific as well as commercial know-how related to the commercialisation of the invention as well as adequate resources. Equally important is that teams have the ability to access other funding. It is important to find a committed person to be responsible of the commercialisation.

Ownership structure and investments made by the University to research results and the spin outs after TUTL-projects, has been recognized as a fruitful good practice. Even though some researchers have felt that the universities ownership of IPR is too big, the ownership ensures the commitment of the University to back the commercialisation of the research idea. The investment is made to make sure that commercializing processes continue also after a TUTL-project ends and before the commercialised idea is maturated enough to receive other sources of finance. Thus, the UH Funds are used to keep the process moving forward.

Investor meetings held twice a year can also be considered as a good practice. In these meetings organised by HIS, TUTL research ideas are presented to interested investors. Emphasis is placed to clearly communicate to the investors the commercial potential and the scientific substance lying in the on-going TUTL projects.

THE ROLE AND IMPORTANCE OF TUTL FOR COMMERCIALISATION IN UH

The current commercialisation activities would have occur the same way in the UH, without TUTL-instrument. TUTL has been used as an integral part of the commercialisation process and it has also guaranteed the University's other support and investments for commercialisation.

TUTL is an important tool and a process to verify and check, whether research inventions have a true potential for commercialisation. TUTL is used as an "interpreter" between scientific ideas and supply and demand in the markets. Without TUTL-funds, the same kind of process would not occur and commercialisation activities would be far more limited and as in-depth analysis of the market potential could not be done without TUTL-instrument.

For a researcher TUTL-instrument has been a safe procedure to test the potential to commercialise inventions and it has encouraged to move forwards. From HIS point of view, the researchers are more active in approaching the commercialisation unit, because they know that there is a possibility to receive TUTL-funding and support for commercialisation.

Innovation Scout has been especially important in the development of the commercialisation processes and also in adjusting the goal of the actions to international partnerships that are considered very important in HSI commercialisation processes. The goal has been in bringing international influences to commercialisation processes and at the same time building new networks. Kino has been important for recruiting new staff in the commercialisation unit. Both have been very important in the development stages of the commercialisation activities of HSI.

SUCCESSFUL CASE EXAMPLE

APCI technology for CBRNE markets and Karsa Oy

The project was preceded by a long-term atmospheric study of cloud formation assessment and on weather measuring instrument testing. The research team had a deep know-how on these matters. Two TUTL projects was implemented by the physics department at the University of Helsinki. The first TUTL was used to commercialize the equipment and know-how in weather related markets and to seek other possibilities for application. At this point, HIS was very important actor in encouraging the team to map out other possibilities to commercialise the technology. It was discovered that the developed measuring instruments were well suited for measuring and detecting explosives. A shift was made to emphasize this application side more. It was noticed that the market potential was already huge and growing in the field of security.

Second TUTL-project was launched after the first one that aimed at commercialising the technology in the security markets. As an example, a prototype was developed for airport security screening in the project. In addition, a suitable leader responsible for commercialisation was found in the TUTL-project. After TUTL-project, substantial marketing efforts were done by HIS to advertise the potential of these instruments to investors. Because of the efforts, private investors have been found to fund the development of the equipment, Tekes has provided roughly 1 million euros to further develop the technology and the UH Funds have also been used for this purpose.

After TUTL-projects, a new company called Karsa Oy has been created. Karsa Oy develops and sells the applications that were atoned for commercialisation in the TUTL-projects. With the help of TUTL, a new application area was found to the cloud formation technology and commercialisation activities were carried out. Important factor for successful commercialisation after TUTL-funding has also been the continuum of funding by Tekes and the UH Funds. Karsa is now focusing on commercialising this technology for several security applications, but specifically around civil aviation.

APPENDIX 3. STATISTICAL INFORMATION OF FUNDED TUTL, KINO AND INNOVATION SCOUT PROJECTS, FUNDING DECISIONS AND PROJECT APPLICATIONS

TUTL FUNDING

TABLE 1. Information of TUTL-applications and TUTL -funding by the end of 2017.

Total amount of applications	1070
Number of positive funding decisions	472
Number of projects	380
Appr. %	44 %
Applied funds	360 Meur
Granted funds	137,5 Meur
Granted funds %	38 %

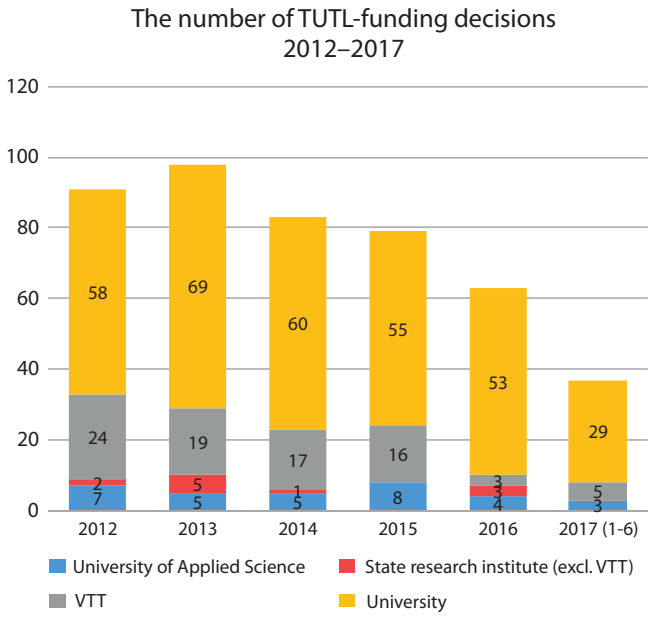
TABLE 2. Information of applications and received funding by organizations.

ORGANIZATION	APPLICATIONS	APPROVED APPLICATIONS	%	APPLIED FUNDING €	RECEIVED FUNDING €	%
Teknologian tutkimuskeskus VTT (VTT oy)	151	84	56 %	44 768 437	23 052 317	51 %
Aalto-korkeakoulusäätiö sr	112	58	52 %	39 797 445	16 837 886	42 %
Lappeenrannan teknillinen yliopisto	100	43	43 %	45 511 858	14 315 536	31 %
Helsingin Yliopisto	92	42	46 %	40 096 053	13 663 610	34 %
Jyväskylän yliopisto	93	28	30 %	43 608 493	11 442 799	26 %
Oulun Yliopisto	75	31	41 %	25 654 466	9 979 380	39 %
TTY-säätiö sr	73	38	52 %	20 137 233	8 557 992	42 %
Turun yliopisto	45	27	60 %	17 095 334	7 138 021	42 %
Tampereen Yliopisto	37	18	49 %	18 189 432	5 966 026	33 %
Itä-Suomen yliopisto	56	24	43 %	15 510 467	4 889 705	32 %
Åbo Akademi	25	15	60 %	7 885 754	3 895 160	49 %
Saimaan ammattikorkeakoulu Oy	22	11	50 %	5 499 734	2 045 547	37 %
Luonnonvarakeskus	5	5	100 %	1 463 211	1 461 300	100 %
Metropolia Ammattikorkeakoulu Oy	22	6	27 %	6 561 830	1 316 743	20 %
Kajaanin Ammattikorkeakoulu Oy	3	2	67 %	1 134 254	777 000	69 %
Ilmatieteen Laitos	3	2	67 %	847 484	615 000	73 %
Oulun Ammattikorkeakoulu Oy	4	3	75 %	1 059 847	560 539	53 %
Mikkelin Ammattikorkeakoulu Oy	7	2	29 %	2 386 099	433 850	18 %
Turun ammattikorkeakoulu Oy	8	2	25 %	1 924 162	362 000	19 %
Satakunnan ammattikorkeakoulu Oy	1	1	100 %	289 422	289 000	100 %
Urho Kekkosen Kuntoinstituuttisäätiö sr	3	1	33 %	832 506	245 000	29 %
Maanmittauslaitos	2	1	50 %	513 112	219 000	43 %
Hämeen ammattikorkeakoulu Oy	1	1	100 %	217 092	217 000	100 %
Taideyliopisto	2	1	50 %	424 604	210 000	49 %
Tampereen ammattikorkeakoulu Oy	3	1	33 %	935 451	201 000	21 %
Työterveyslaitos	3	2	67 %	475 398	199 600	42 %
MAA- JA ELINTARVIKETALOUDEN TUTKIMUSKESKUS	2	1	50 %	433 507	157 000	36 %
Vaasan Yliopisto	5	1	20 %	894 305	150 000	17 %
Jyväskylän Ammattikorkeakoulu Oy	13	1	8 %	3 319 082	133 000	4 %
Kemi-Tornionlaakson koulutuskuntayhtymä Lappia	2	1	50 %	552 854	94 600	17 %
Savonia-Ammattikorkeakoulun kuntayhtymä	4	1	25 %	817 992	60 000	7 %

TABLE 3. Information of applications and applied funding of organizations that didn't receive funding.

ORGANIZATION	APPLIOCATIONS	APPROVED APPLICATIONS	%	APPLIED FUNDING €	RECEIVED FUNDING €	%
AINOVIA OY	1	0	0 %	60 000	0	0 %
Geodeettinen laitos	3	0	0 %	745 939	0	0 %
Kajaanin kaupunki	2	0	0 %	665 105	0	0 %
Karelia Ammattikorkeakoulu Oy	2	0	0 %	385 751	0	0 %
Kymenlaakson Ammattikorkeakoulu Oy	2	0	0 %	1 030 188	0	0 %
Lapin ammattikorkeakoulu Oy	1	0	0 %	75 000	0	0 %
Lapin Yliopisto	2	0	0 %	790 293	0	0 %
Laurea-ammattikorkeakoulu Oy	5	0	0 %	1 039 753	0	0 %
METSÄNTUTKIMUSLAITOS	5	0	0 %	1 525 760	0	0 %
Mittatekniikan keskus	1	0	0 %	85 511	0	0 %
Oulun seudun koulutuskuntayhtymä (OSEKK)	6	0	0 %	1 482 301	0	0 %
Päijät-Hämeen koulutuskonserni-kuntayhtymä	3	0	0 %	578 105	0	0 %
Rindell Eevastiina	1	0	0 %	490 000	0	0 %
Rovaniemen koulutuskuntayhtymä	1	0	0 %	213 403	0	0 %
Seinäjoen Ammattikorkeakoulu Oy	1	0	0 %	91 343	0	0 %
Seinäjoen koulutuskuntayhtymä	1	0	0 %	67 318	0	0 %
Stiftelsen Arcada sr	4	0	0 %	1 073 210	0	0 %
Suomen ympäristökeskus	2	0	0 %	573 024	0	0 %
Svenska Handelshögskolan	1	0	0 %	157 638	0	0 %
TURUN KAUPUNKI	2	0	0 %	321 001	0	0 %
	1 020	454	45 %	360 287 561	133 775 734	37 %

FIGURE 1.
Annual information of TUTL-projects by organization type.



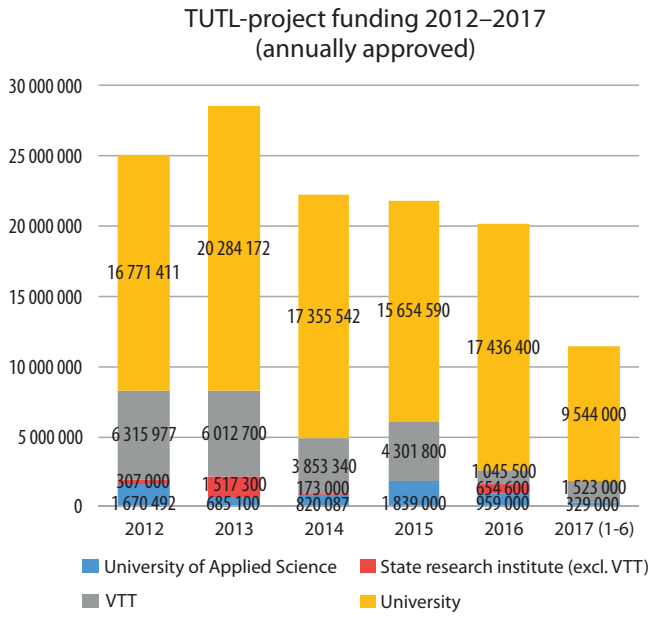
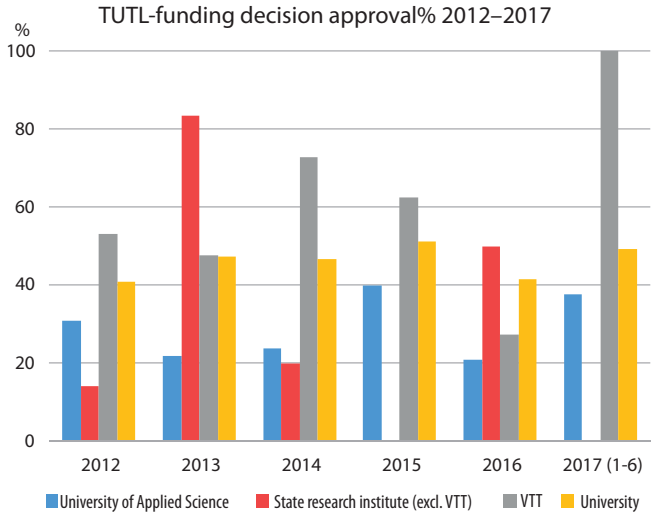


FIGURE 2.
Approval percentages of TUTL-funding decisions by organization type.



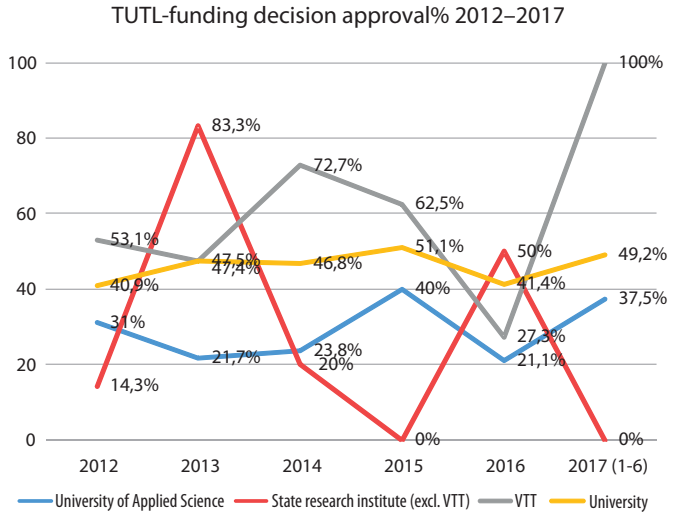


FIGURE 3. Approved TUTL-funding 2012-2017 by organization type.

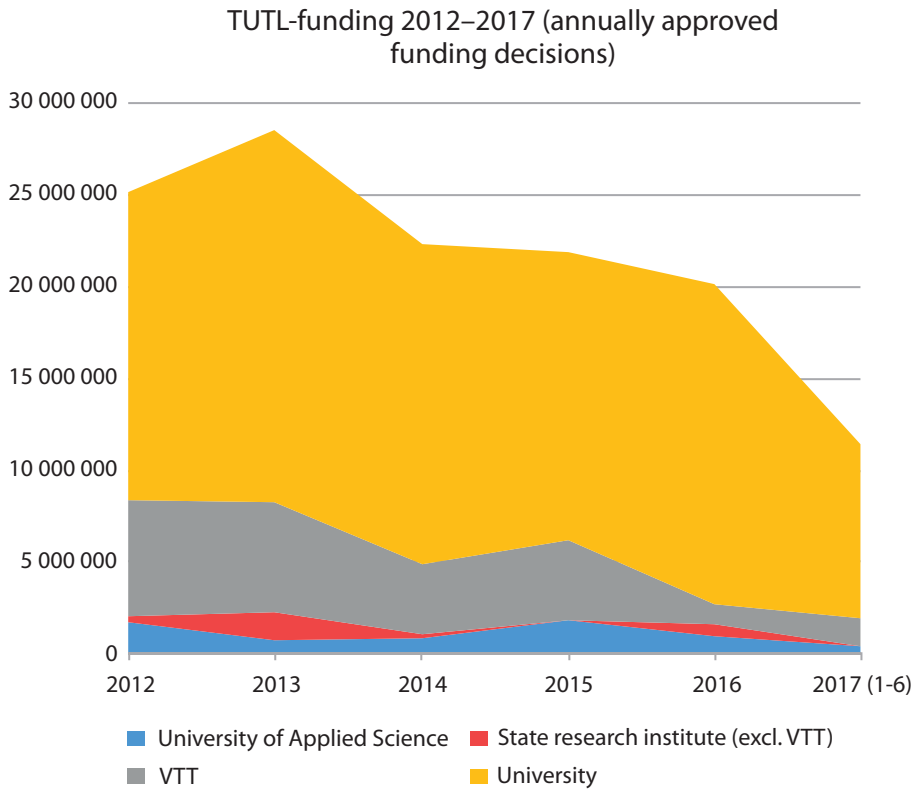
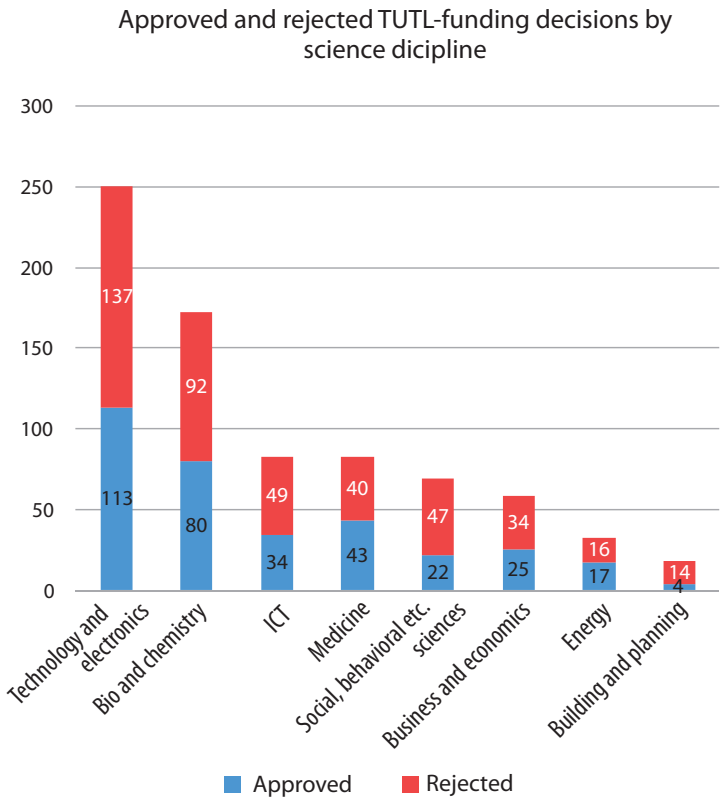


FIGURE 4.
Information of approved and rejected funding decisions by science discipline.



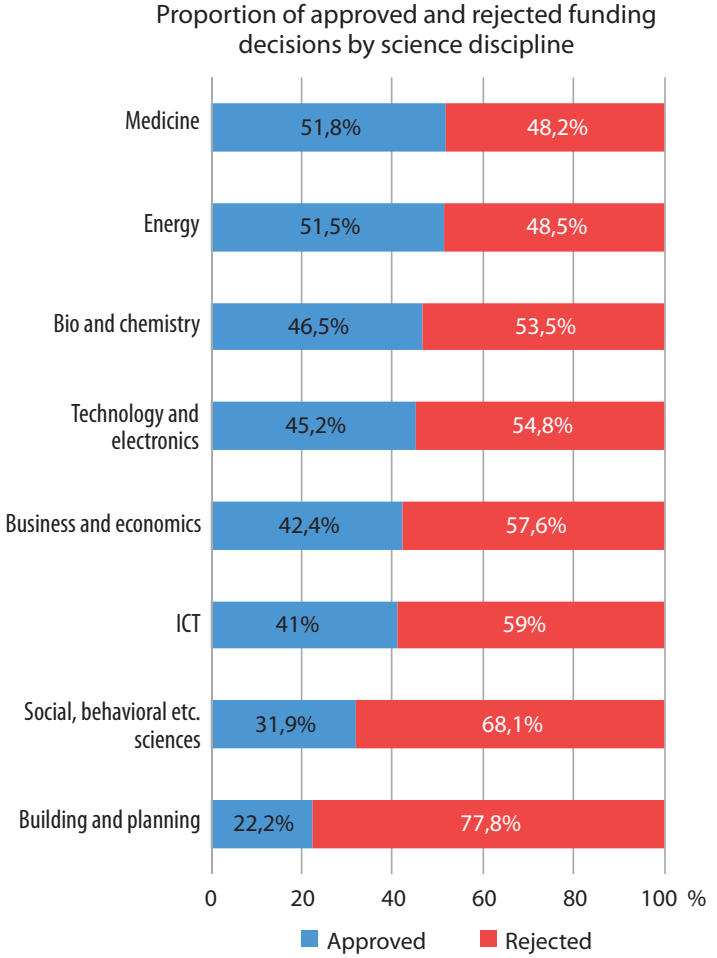
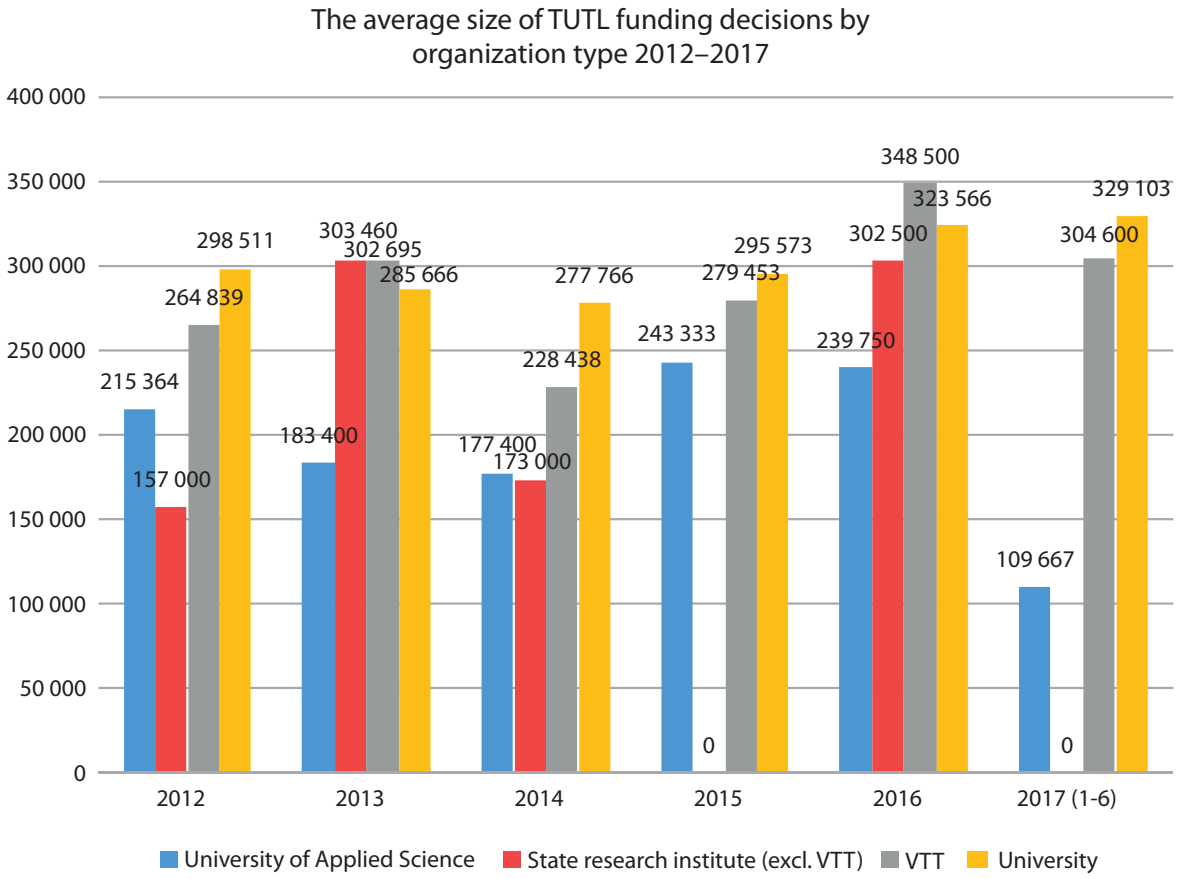


FIGURE 5. The average annual size of TUTL-projects by organization type.



KINO FUNDING

TABLE 4. KINO funds received by different organizations.

APPROVED	EUROS
Aalto-korkeakoulusäätiö sr	680 000
Helsingin Innovaatiopalvelut Oy	401 000
Metropolia Ammattikorkeakoulu Oy	300 000
Teknologian tutkimuskeskus VTT Oy	282 000
Turun yliopisto	279 200
Turun ammattikorkeakoulu Oy	270 000
Oulun Yliopisto	261 000
Helsingin Yliopisto	248 000
Åbo Akademi	220 000
Jyväskylän yliopisto	217 000
Luonnonvarakeskus	171 000
TTY-säätiö sr	166 500
Tampereen ammattikorkeakoulu Oy	160 000
Itä-Suomen yliopisto	149 000
Tampereen Yliopisto	149 000
Lahden ammattikorkeakoulu Oy	125 000
Lappeenrannan teknillinen yliopisto	57 350
Saimaan ammattikorkeakoulu Oy	35 000
Taideyliopisto	0

TABLE 5. Organizations that have applied, but not received KINO-funding.

REJECTED
Centria-ammattikorkeakoulu Oy
Hämeen ammattikorkeakoulu Oy
Lapin Yliopisto
Laurea-ammattikorkeakoulu Oy
Oy Vaasan ammattikorkeakoulu
Satakunnan ammattikorkeakoulu Oy
Savonia-ammattikorkeakoulu oy
Suomen ympäristökeskus
Vaasan Yliopisto

INNOVATION SCOUT FUNDING 2016

TABLE 6. Innovation Scout funds received by different organizations.

APPROVED	EUROS
Helsingin Innovaatiopalvelut Oy	487 000
Aalto-korkeakoulusäätiö sr	431 000
Turun ammattikorkeakoulu Oy	260 000
Jyväskylän yliopisto	240 000
Tampereen ammattikorkeakoulu Oy	145 000
Teknologian tutkimuskeskus VTT Oy	141 000
Turun yliopisto	120 000
Metropolia Ammattikorkeakoulu Oy	119 000
Haaga-Helia ammattikorkeakoulu Oy	117 000
Laurea-ammattikorkeakoulu Oy	109 800
TTY-säätiö sr	107 000
Oulun Yliopisto	99 600
Tampereen Yliopisto	98 000
Lappeenrannan teknillinen yliopisto	97 700
Jyväskylän Ammattikorkeakoulu Oy	92 400
Aalto-yliopistokiinteistöt Oy	78 400
Åbo Akademi	76 240
Helsingin Yliopisto	65 000
Itä-Suomen yliopisto	41 600
Saimaan ammattikorkeakoulu Oy	40 000
Lahden ammattikorkeakoulu Oy	33 360
Taideyliopisto	17 600

APPENDIX 4. RESULTS AND STATISTICS REGARDING SURVEYS CONDUCTED IN THE EVALUATION PROJECT

QUESTIONNAIRE FOR TUTL-PROJECT CONTACT PERSONS

SUMMARY

The questionnaire was carried out between 29.9.2017–13.9.2017. During this period 144 answers was received, which was 46% of all of potential respondents.

Of the respondents, 79% represented Universities, 13% State research organizations, 6% University of Applied Sciences (Ltd.) and 2% represented State-owned non-market based companies.

Added value of TUTL-funding

- High number of the TUTL projects and the project content (57%) would not have been implemented at all without TUTL-funding. Funding has been crucial for the execution of many project-ideas and in enabling the commercializing actions to take place. Only 1% of projects would have been carried out exactly the same way even without TUTL.
- Less than 40% of respondents thought that their project would have been executed in some way even if they wouldn't have received TUTL-funding. Added value of TUTL-funding to these projects have been:
  - TUTL-funding has enabled projects to be executed earlier and enabled reaching the desired results at quicker pace. Less than 20% of TUTL-projects would have been executed even without TUTL-funding, but later or with at a slower pace.
  - TUTL funding has increased ambitions of the projects and enhanced the scale of their commercialisation. 17% of the projects would have been implemented but with more limited content and as a smaller project.
  - TUTL has also influenced the project content and direction. 20% of the projects would have been implemented with different goals/formats/partners/ usually as a smaller and less ambitious project.

Functionality of TUTL-instrument and project implementation

- TUTL-projects have worked best as research and development platform of ideas. Projects have worked well in developing ideas towards commercialisation and producing information relevant to utilization of research ideas.

- Projects have been less successful in the issues related more closely to actual commercialisation of ideas. Commercialisation, internationalization, experimental activities and IPR-issues have caused more problems.
- TUTL-process has worked quite well generally. Reporting practices, issues related to the clarity of acceptable costs and steering and monitoring from Tekes have been well functioning. In these matters, over 85% of respondents have been either very satisfied or fairly satisfied.
- More often problems and obstacles have been in the clarity of conditions and criteria for obtaining funding as well as in bringing positive influence from Tekes expertise to TUTL-projects. Even with these issues, most of the projects have been very satisfied or fairly satisfied.
- Overall, 47% of respondents have been very satisfied and 43% have been fairly satisfied with the functionality of TUTL-process.

Results and impacts

- So far, TUTL-projects have been more successful in producing knowledge and know-how, of how to utilize the research idea and making preparatory measures for the commercialisation of research idea and clarifying the utilization paths of the research results.
- Projects have been less successful in utilizing the research results in the businesses of new companies and in maturing the research idea to be funded by private resources as well. Especially in utilizing the research results as a new business in existing companies, TUTL-projects have not been widely successful.
- TUTL-projects seem to be creating new businesses well, but for the most part the businesses haven't been created yet, but will be in the future. Less than 5% of respondents feel that no new business will be created as a result of their project and 28.4% reported that new business has already been created and 67.2% reported that new business will be created in the future.
- Project teams have been the most important actors for commercialisation in TUTL-projects. The commercialisation of TUTL-projects has mainly been done by project-teams themselves, and only in about 30% by an external actor (Marketing unit of the organization or External consultant). In most TUTL-projects the actor responsible of commercialisation has been either a member of the project team (36.8%) or the leading researcher/project manager (33.1%).
- Clear majority of the new business is created/is planned to be created in new start-ups and much fewer as a part of already existing company.
- For the organizations that have received TUTL-funding, TUTL's added value has been especially important in the encouragement and activation of these organizations towards making commercialisation activities of research results. TUTL has also been important in developing practices and tools for commercialisation process (preparation and implementation of projects, identifying potential ideas, enhancing commercialisation skills).

- TUTL hasn't been yet as significant in improving the ability and giving tools to actually commercialize ideas e.g. helping to find other financiers and partners, for the transfer of know-how from projects onwards to other actors and in helping to handle and manage contractual matters (eg IPR).

FIGURE 1. Successfulness of TUTL-project implementation from different perspectives evaluated by TUTL-project contact persons.

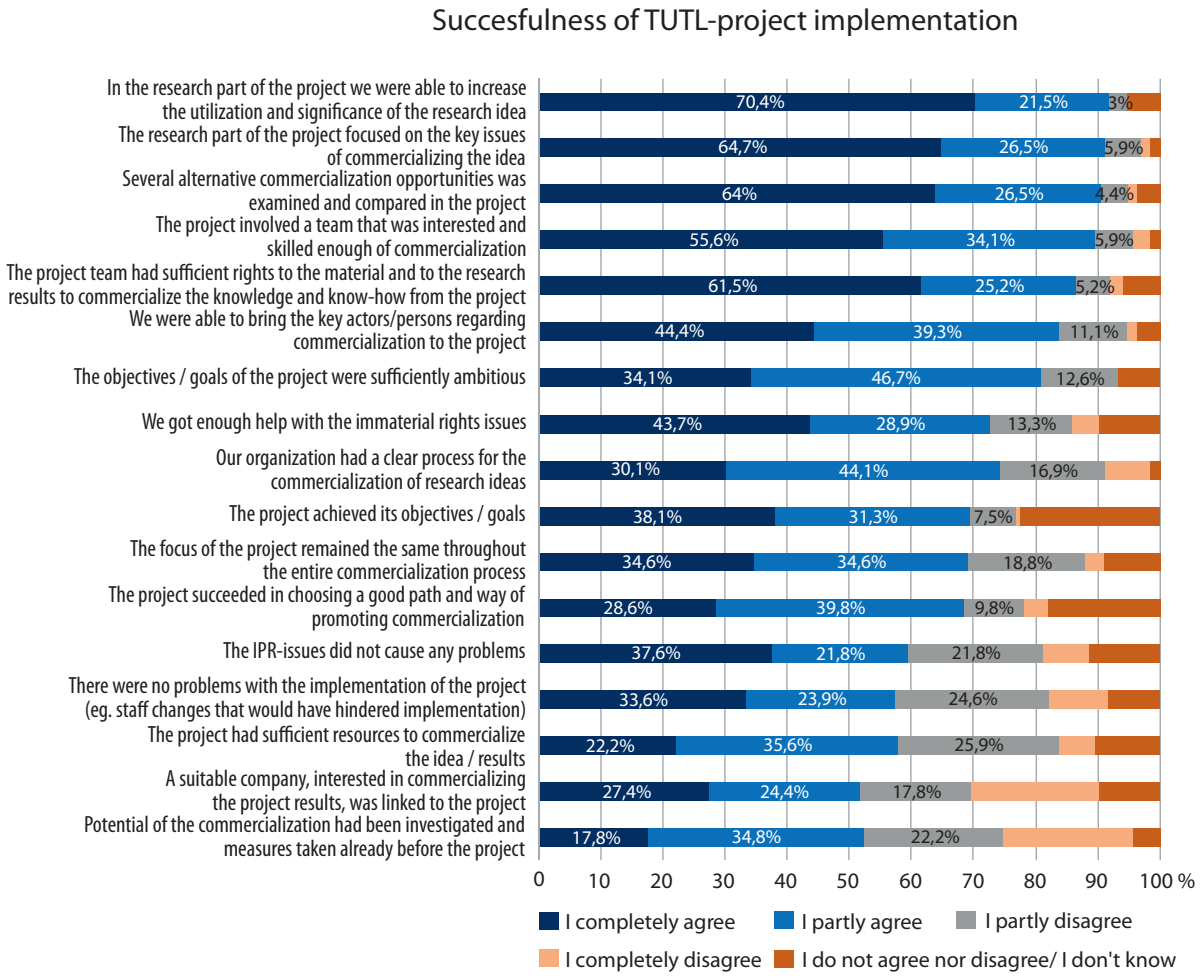


FIGURE 2.
The persons/actors responsible for the commercialisation of research results in TUTL-projects and TUT-project contact person's opinion on the importance and successfulness of different actors for commercialisation.

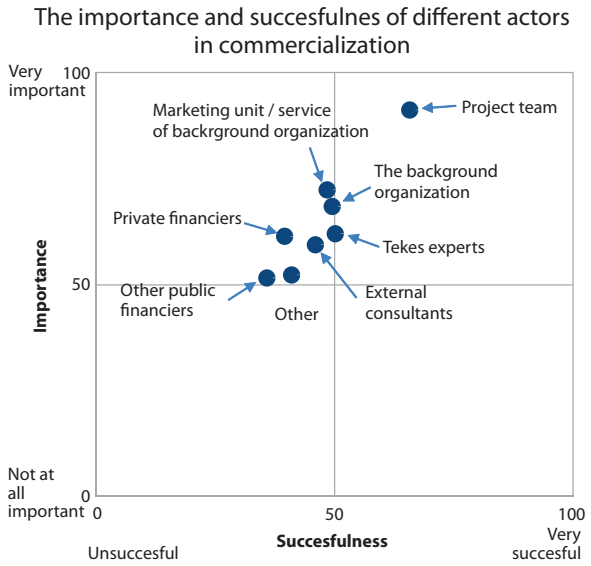
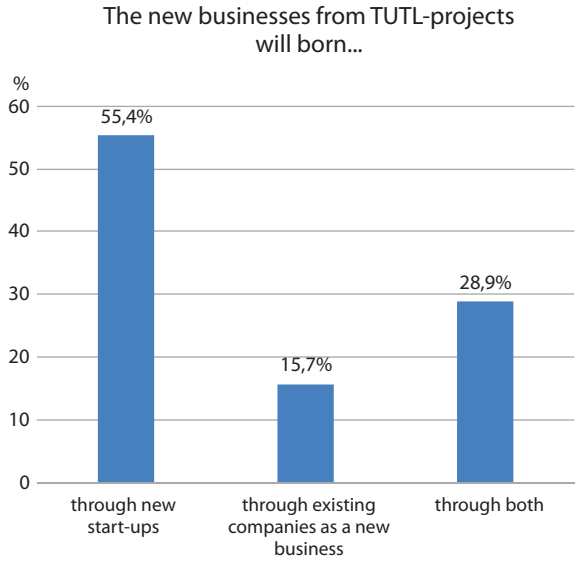


FIGURE 3.
TUTL-project contact persons view on where new businesses form TUTL-projects will be created and information from questionnaire of the birth of new spin-offs/ start-ups as a result of TUTL-project.



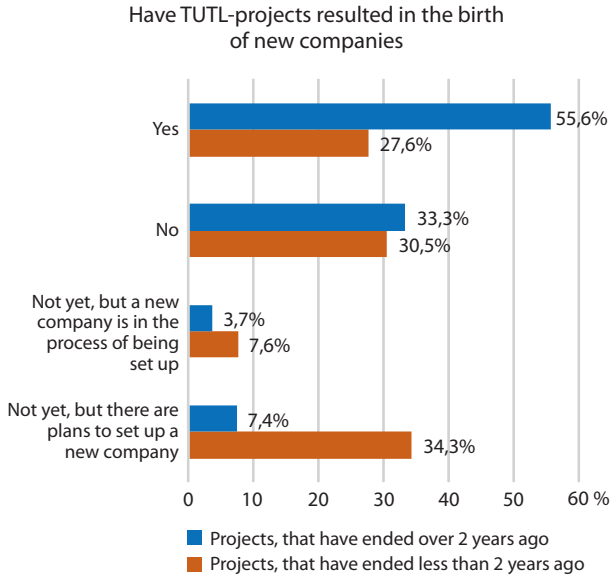
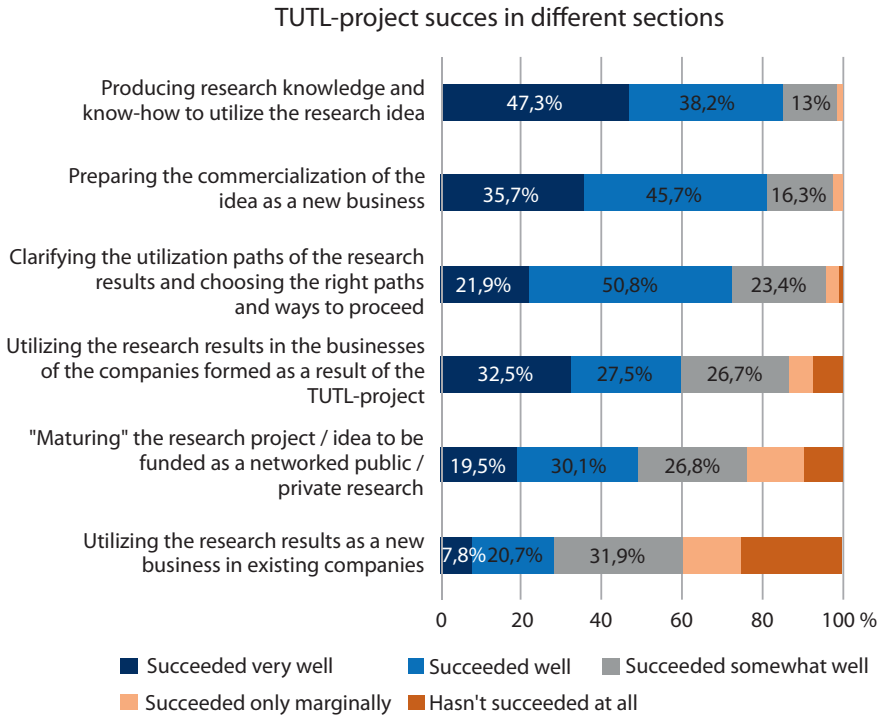


FIGURE 4. TUTL-projects successfulness in different target areas evaluated by TUTL-project contact persons.



QUESTIONNAIRE FOR RESEARCHERS AND RESEARCH GROUPS THAT HAVE APPLIED BUT HAVE NOT RECEIVED TUTL FUNDING FROM TEKES

SUMMARY

The questionnaire was carried out between 10.10.2017–17.10.2017. During this period 55 answers was received, which was 17% of all of potential respondents.

Of the respondents, 78% represented Universities, 13% State research organizations, 8% University of Applied Sciences (Ltd.) and 2% represented State-owned non-market based companies.

- Most of the project applications and project ideas, that didn't receive TUTL-funding, haven't been implemented at all afterwards using other funding (78% of projects). TUTL has been crucial instrument and the only suitable financing instrument for these project ideas.
- Little less than 15% of projects have been executed as smaller projects/with more modest objectives/in a longer time-span than was planned in TUTL-application. Only very few applications (6%) have been implemented with same content as in TUTL-application. These projects have been funded using several different funding sources e.g. ELY, private company funding, Tekes' other instruments and also by using researchers own resources and spare time.
- The TUTL-application projects that didn't receive TUTL funding but have been implemented have generally been less capable than TUTL-funded projects in their ability in commercializing research ideas and in the implementation of the projects.
- Less than a half (44%) of the respondents that haven't received TUTL-funding have had other projects aiming for commercializing research results in last 3 years.
- In the organizations that have made TUTL-applications but have not received funding (at least to some of their applications), commercialisation of research is not particularly strongly and widely at the core of the operations and there also seems to be differences among these organizations. The biggest obstacles seem to be the lack of resources and the lack of clear strategies for commercialisation.
- The project team clearly as the most important actor for commercialisation largely the same way as TUTL-project representatives. Other actors are less relevant.

FIGURE 1. Projects that have been implemented without TUTL-funding ability and success for commercialisation.

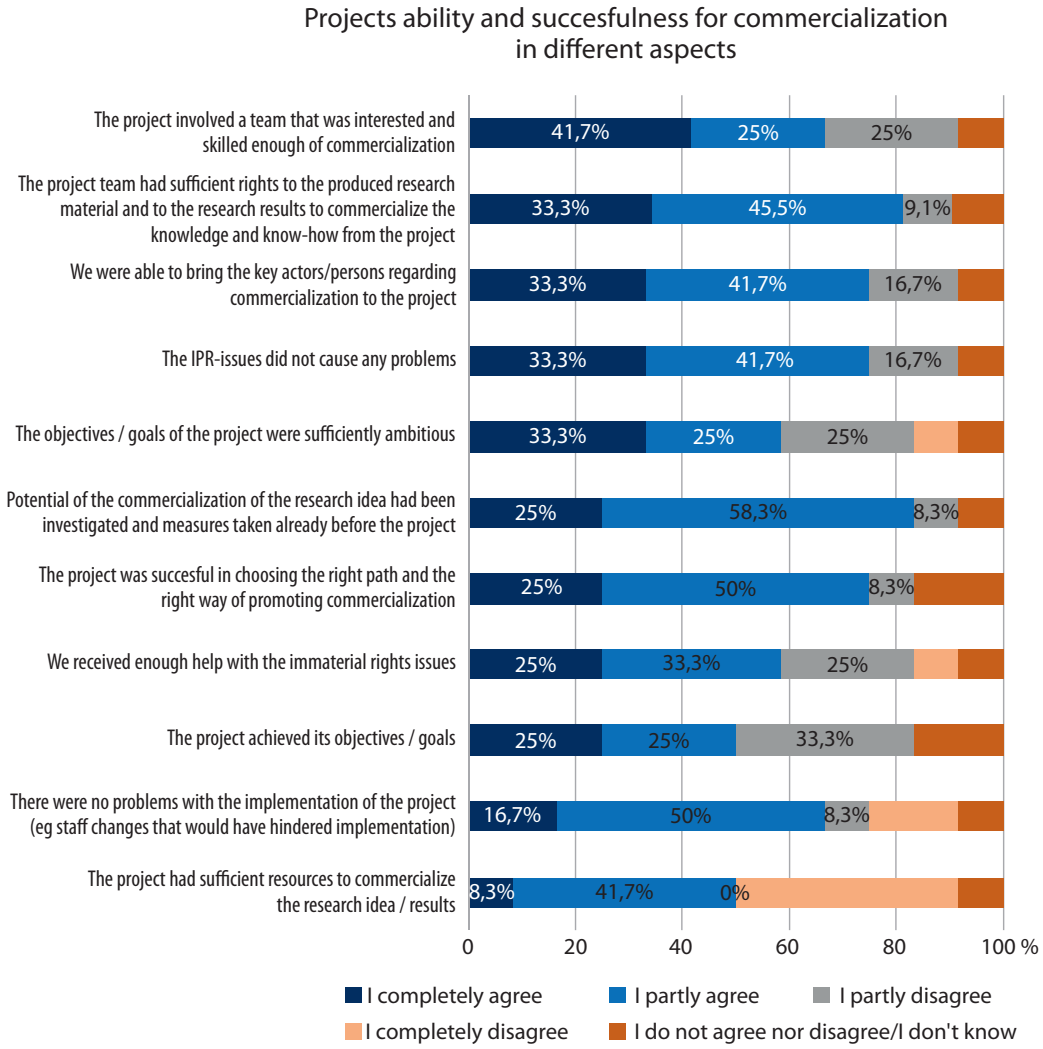


FIGURE 2. The prevalence of projects with commercial goals in organizations that have not received TUTL-funding.

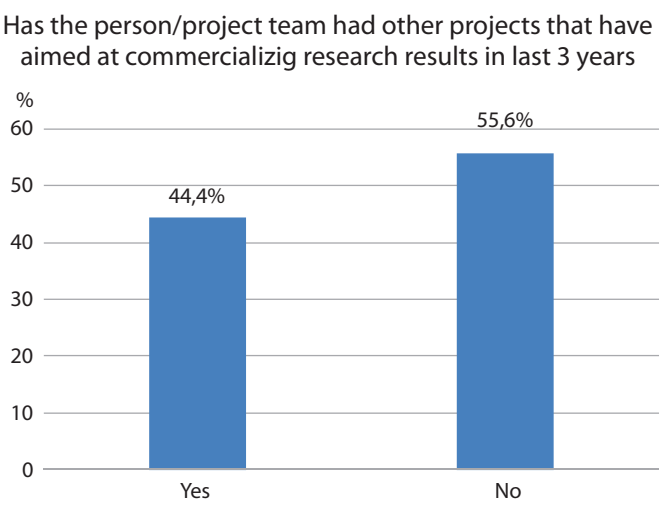


FIGURE 3. Commercialisation of research results in organization that have not received TUTL-funding for all applications.

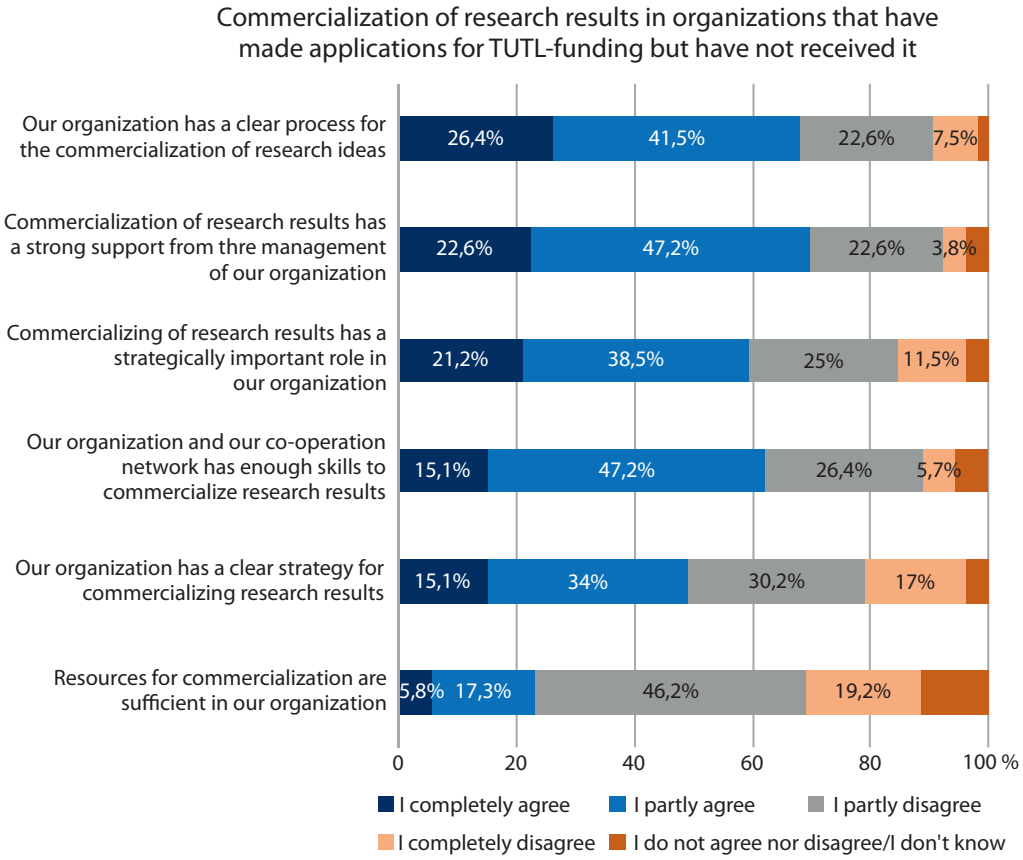
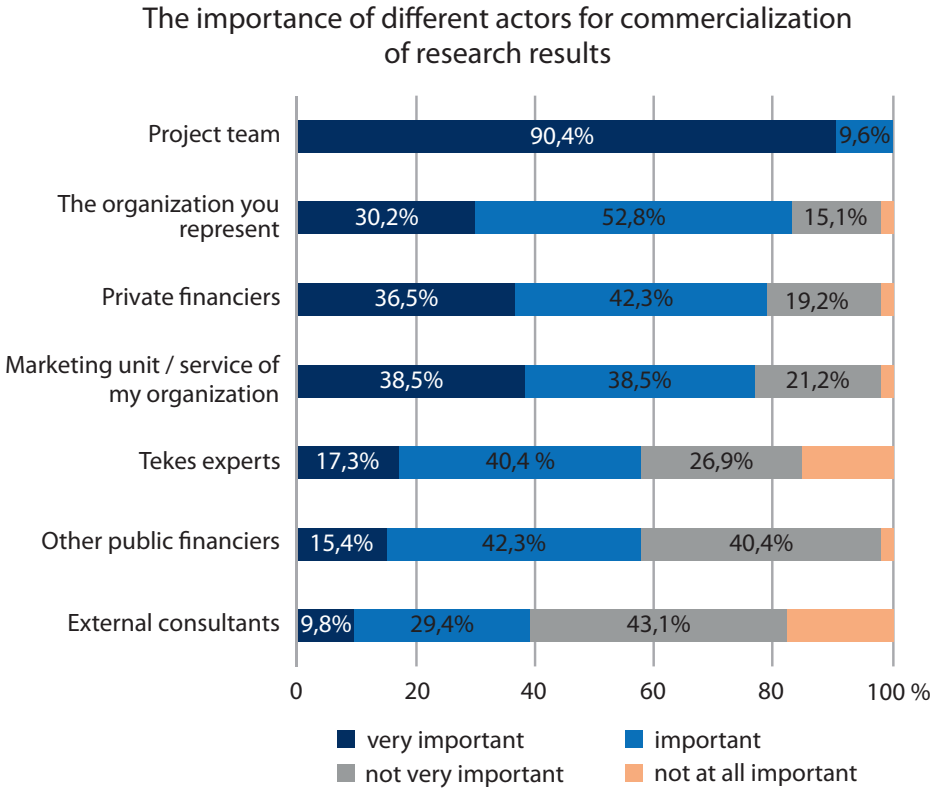


FIGURE 4. Importance of different actors for the commercialisation evaluated by representatives of projects that have not received TUTL-funding.



QUESTIONNAIRE FOR TEKES' INNOVATION SCOUT-PROJECT CONTACT PERSONS AND PERSONS RESPONSIBLE FOR PROJECTS

SUMMARY

The questionnaire was carried out between 10.10.2017–17.10.2017. During this period 16 answers was received, which was 33% of all of potential respondents.

Of the respondents, 67% represented Universities and 33% represented University of Applied Sciences (Ltd.).

- The ability to commercialize research results has improved clearly during the last 3 years in research organizations in Finland. Resources to commercialize still present a challenge.
  - The Universities of Applied Science do not have a similar support from organization leadership and strategy to commercialize, as Universities. The differences in ability to commercialize seems to be related to differences of strategic positioning of commercialisation.
  - Both Innovation Scout and TUTL have had a significant impact in research organizations improved ability to commercialize.
  - Tekes Innovation Scout and TUTL-funding is practically the only instrument that can be used to promote science-based, IPR-intensive innovation with a strong commercializing emphasis.
  - Innovation Scout has been used to get a wider scope of people in research organizations to co-operate in enhancing commercialisation. Without external funding this would not have happened.
  - Innovation Scout and KINO have enabled the creation of structure and mechanisms to disseminate research results and patents to businesses.
  - Tekes funding has increased the know-how related to IPR and commercializing and it has raised the awareness of commercialisation in organizations.
  - Tekes funding has also given a mandate and resources to focus on commercializing research results and it has directed more resources from research organizations to commercializing activities.
  - Tekes' resources have strengthened co-operation between research organizations and private companies and opened new research infrastructures outside research organizations.
- Innovation Scout has worked as planned. However, research organizations come from different situations and are different regarding what kind of added value can be achieved from Innovation Scout projects.
- Nevertheless, the added value of Innovation Scout is regarded important in all organizations
- The Universities of Applied Science have benefitted relatively more of the development of practices, tools and processes, than Universities.
- Universities have relatively benefitted more of the improved commitment, creation of new IPR transfer solutions and increase in the number of ideas to be commercialized.

- Further funding after Innovation Scout would be important for several organizations to make sure the created structures and processes would become permanent and the structures and processes could be developed further. In this case, KINO was followed by Innovations Scout too quickly and more time would have been needed.
- The co-operation between Universities in commercializing should be increased and the organization specific commercialisation services could be developed so that they could be utilized by other research organizations as well.

FIGURE 1.
Number of different type of organizations that replied to the questionnaire and number of commercializing projects that respondent organizations have had during the last three years.

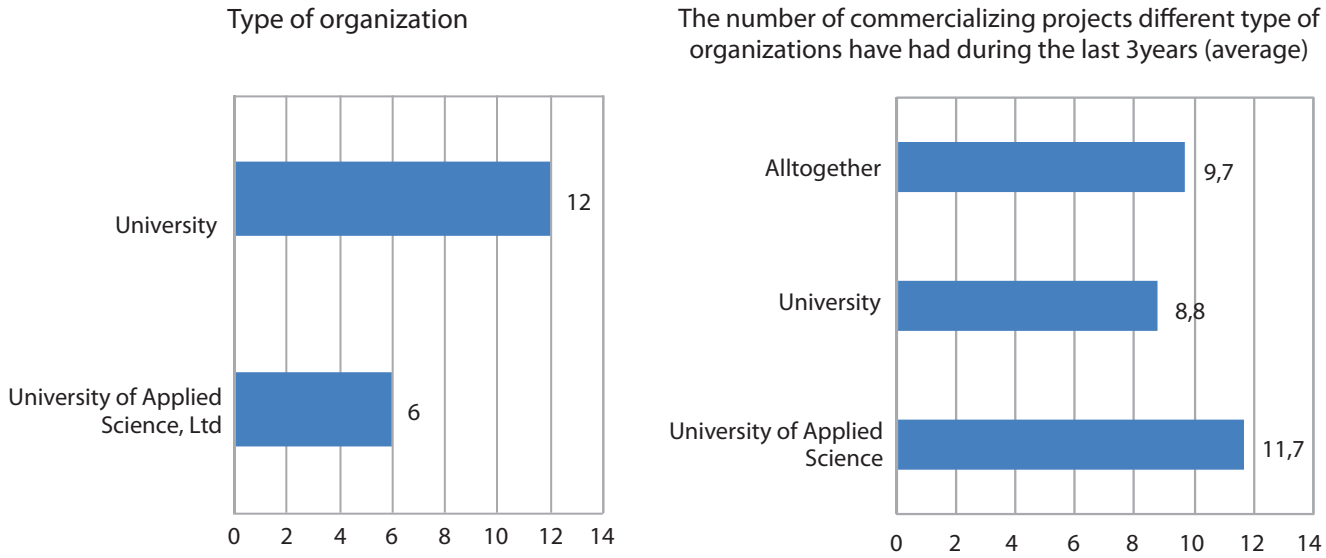


FIGURE 2.
Development of circumstances and abilities to commercialize research results in research organizations.

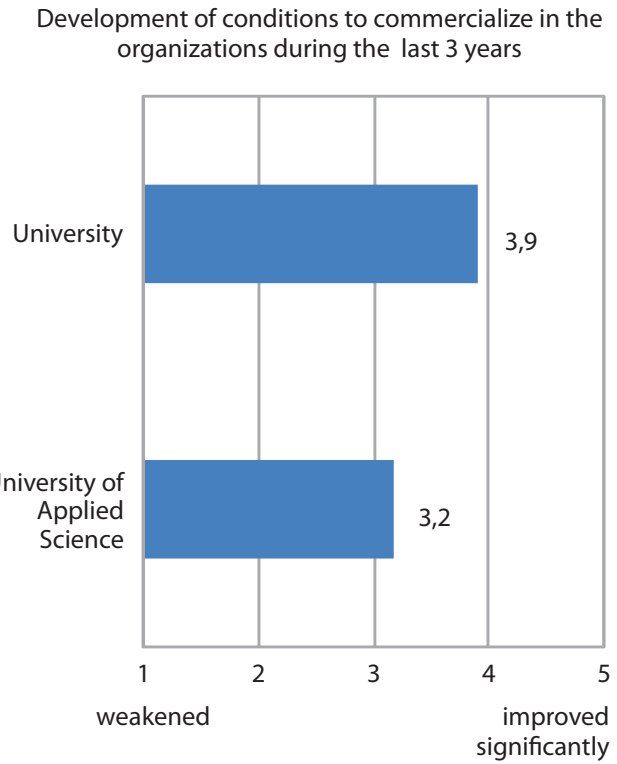


FIGURE 3. Different aspects of commercialisation of research results in organizations that have used Innovation Scout funding, evaluated by persons responsible of Innovation Scout -projects.

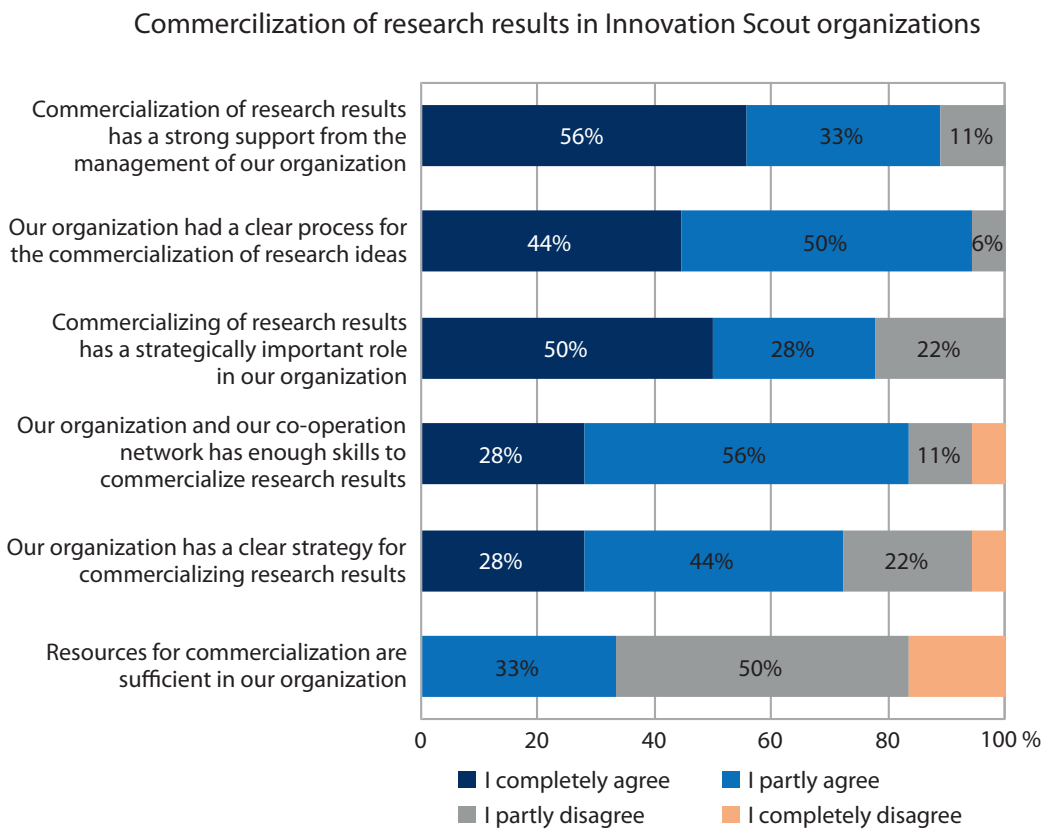


FIGURE 4. The Importance of Innovation Scout and KINO for organizations that have received funding form the instruments on different matters.

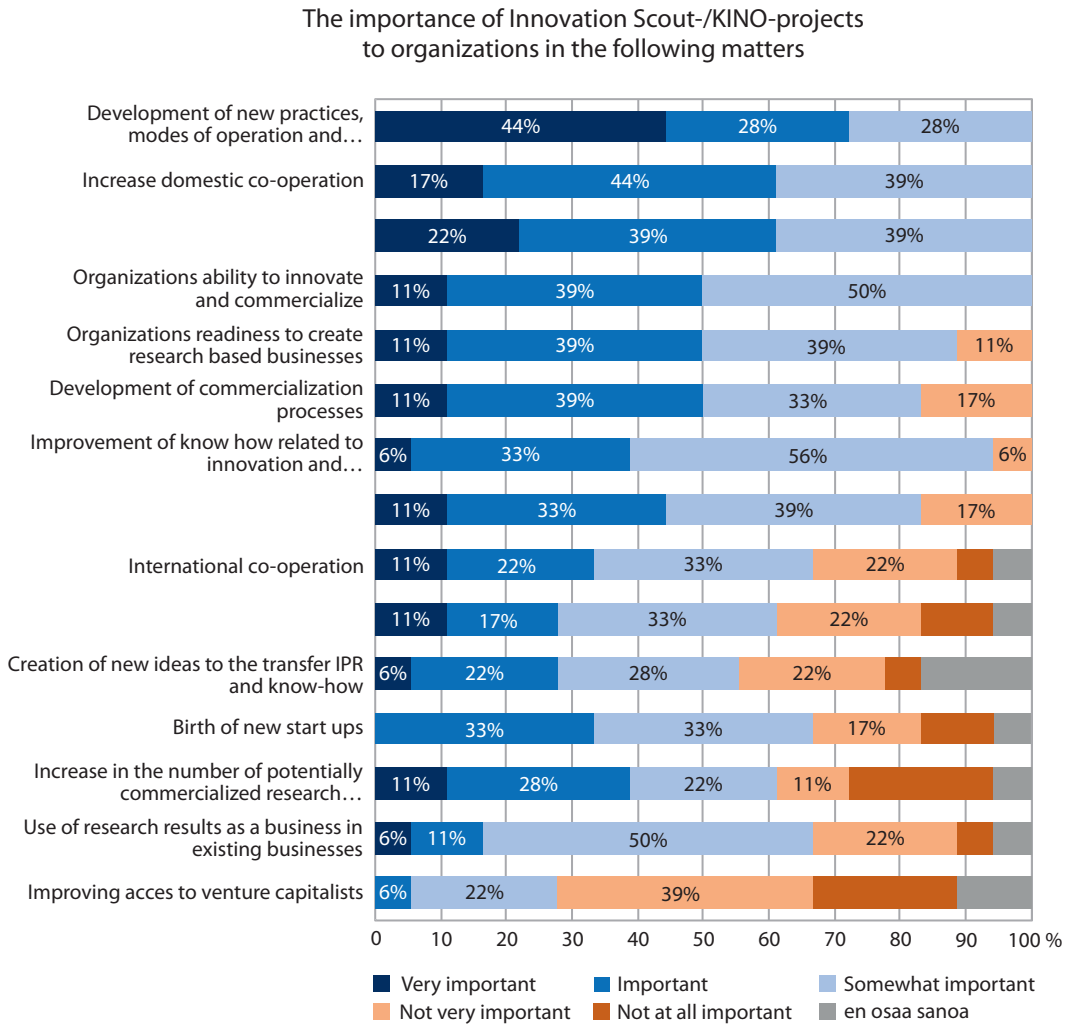


FIGURE 5. The overall importance of Tekes funding for organizations ability to prepare commercialisation of research results.