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Project-based Funding and Novelty in University Research

Findings from Finland and the UK

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This report relates findings of a project entitled "Universities, funding systems, and the renewal of the industrial knowledge base" and funded by Tekes from its innovation research instrument. It has partners from ETLA, VTT, University of Helsinki, Aalto University, the University of Manchester, UK, and University of California, Davis. The project ran from 2012 to 2014.

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Abstract

While societal expectations for university research have grown, university research has become more and more dependent on external funding sources. External funding has substantially increased at Finnish – and also UK – universities, and currently in practice a major share of university research is conducted with external funding. This report relates the main findings of a study that analysed the use of project-based research funding instruments at universities, most of which are external. The main focus in the study is on the aspects of novelty and creativity in research and the question of the extent to which different research funding instruments promote these aspects of research. This report draws on different data sources, but mostly on the UNI project (Universities, funding systems, and the renewal of the industrial knowledge base), funded by Tekes innovation research instrument.

The major findings include an observation that Finnish research funding system lacks a funder that would strongly encourage risk-taking and novel approaches. Discontinuity and instability of research funding appears as a major challenge for research. There seems to be an overall increase of thematically predefined funding vis-à-vis free researcher-driven funding and close attention should be paid to this balance. Differences between Finland and the UK in terms of novelty generation turned out to be smaller than originally expected.

Key words: Funding, university research, novelty

JEL: JEL O38, O39

Projektirahoitus ja tutkimuksen innovatiivisuus yliopistoissa – Tutkimustuloksia Suomesta ja Iso-Britanniasta

Tiivistelmä

Samalla kun yhteiskunnalliset odotukset yliopistojen tutkimustoimintaa kohtaan ovat kasvaneet, yliopistotutkimus on tullut aiempaa riippuvaisemmaksi ulkoisista rahoituksen lähteistä. Ulkoinen tutkimusrahoitus on kasvanut merkittävästi sekä suomalaisissa että Iso-Britannian yliopistoissa, ja käytännössä valtaosa yliopistotutkimuksesta tehdään ulkopuolisen rahoituksen turvin. Tämä raportti kohdistuu siihen, missä määrin tutkimuksen rahoitusinstrumentit, jotka ovat valtaosin projektilähtöisiä ja ulkopuolista rahoitusta, edistävät luovuutta ja tutkimuksen innovatiivisuutta uutuusarvon merkityksessä. Raportti käyttää useita lähteitä, mutta enimmäkseen se pohjautuu Tekesin innovaatiotutkimuksesta rahoitettuun UNI-hankkeeseen (Universities, funding systems, and the renewal of the industrial knowledge base).

Tutkimuksen tärkeimpiin havaintoihin kuuluu se, että Suomen rahoitusjärjestelmästä puuttuu rahoittajia, jotka tukisivat riskinottoa ja uusia lähestymistapoja. Rahoituksen katkonaisuus ja epävarmuus vaikeuttavat tutkimuksen aihealueiden pitkäjänteistä työstämistä.

Temaattisesti määritelty tutkimusrahoitus on kasvanut vapaan ja tutkijalähtöisen tutkimuksen kustannuksella, ja se on seikka, johon rahoittajien kannattaisi kiinnittää jatkossa huomiota. Suomen ja Iso-Britannian väliset erot tutkimuksen rahoitusjärjestelmien suhteen olivat pienempiä kuin alun perin odotettiin.

Asiasanat: Rahoitus, yliopistotutkimus, tutkimuksen innovatiivisuus

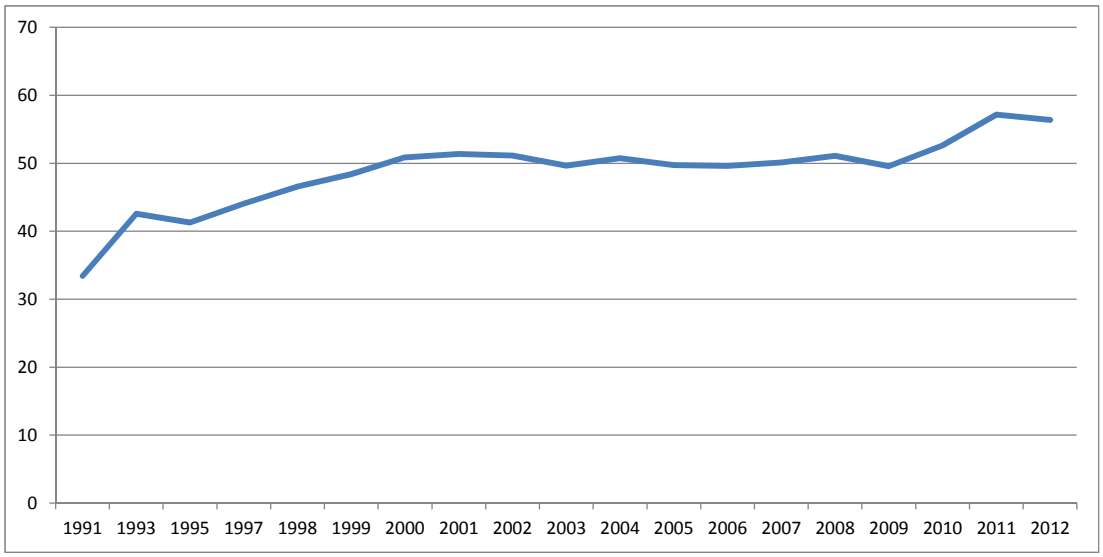
JEL: JEL O38, O39

1 Introduction

In the knowledge-based economy, the role of universities as central knowledge-producing organisations has become increasingly salient (e.g. Mintrom, 2009). While universities' traditional main functions relate to education of future generations and knowledge production through basic (and applied) research, now wider expectations are being placed on universities. On the one hand, universities face the requirement of scientific excellence: attainment of world class excellence and production of 'ground-breaking' or 'frontier research' (OECD, 2014; Langfeldt et al., 2013). On the other, universities are increasingly also expected to contribute to economic growth through commercialisation, entrepreneurship and industry collaboration (e.g. Etzkowitz, 2013). These trends have been strongly affected by growing global economic and scientific competition.

While societal expectations for university research have grown, university research has become ever more dependent on external funding sources. External funding has substantially increased at Finnish – and also at UK – universities. Currently in practice a major share of university research is conducted with external funding. Between 1991 and 2012 the share of external research funding of all research funding at Finnish universities grew from 33 per cent to 56 per cent (Figure 1).[1] This implies that the research funding system has been developed into an increasingly competitive mode (Auranen, 2014). The availability and conditions of external research funding instruments thus potentially strongly affect the nature of the research that can be conducted at universities.

Figure 1 Share of external research funding of all research funding at Finnish universities, 1991–2012 (%)



Source: Statistics Finland (http://193.166.171.75/Database/StatFin/ttt/tkke/tkke_fi.asp)

[1] In 1991 external research funding at Finnish universities was 239 million euros while in 2012 it was 549 million euros (Statistics Finland).

This report relates the main findings of a study that has analysed the use of primarily external project-based research funding instruments at universities. The main focus here is on aspects of novelty and creativity in research and on how different research funding instruments promote these aspects. We seek to answer the following questions: How and to what extent do different research funding instruments enable, facilitate or encourage research that can lead to discoveries with important industrial, economic or social implications? To what extent do the studied funding instruments promote highly innovative ideas in research?

Following the insights of previous studies on highly innovative research, such research entails new avenues of inquiry, it is unexpected, and, at least at first, it can create controversy. There may be a high risk of not achieving what is expected, unconventional ideas and even speculative elements (e.g., Travis and Collins, 1991; Grant and Allen, 1999; Heinze, 2008; Luukkonen, 2012). Interdisciplinary research is often regarded as highly innovative and entails much risk (Laudel, 2006). In order for research funders to support such efforts, they need to provide funding that allows researchers to embark upon new lines of research in new research areas, and because of the associated high risk, to make changes in their research plans, and to have time to pursue novel ideas until they become sufficiently stabilized and more widely accepted.

Accordingly, we defined the following aspects of funding sources as vital to assess their support for highly innovative research:

- **The leeway** the funding source provides to the researcher to define the research problem and to make changes during the project,
- **Stability**, i.e., the length and volume of the funding and possibility to renew the grant,
- The possibility to **move to a new research field** (in which the researcher does not have previous activity), and
- The possibility to open up completely **new research lines** in the field (novel approaches, risk-taking).

In this study, the main focus is on the major research funding sources/schemes in Finland. Data from the UK is also reported to provide comparison. The following national and European-level research funding sources (organisations) are studied: Research Councils that fund basic research (Academy of Finland and seven national Research Councils in the UK), bodies funding applied research (Tekes in Finland and the Technology Strategy Board in the UK), European Union Framework Programmes, the European Research Council, industry, foundations and universities' own (internal) funds.

2 Data

The principal data for this study consists of 80 thematic interviews with research group leaders at universities in Finland (59) and the UK (21). In Finland interviews were carried out in six research fields (computer science, chemistry, cancer research, urban studies, energy research and archaeology) and seven universities (Aalto University, University of Helsinki, University of Turku, University of Jyväskylä, University of Oulu, Lappeenranta University of Technology, University of Eastern Finland). In the UK, interviews were conducted with research group

leaders in two areas: computer science, energy research, and in two universities: Leeds University and Imperial College. In addition, research policy-makers and representatives of university administration were interviewed in Finland (20) and in the UK (2). Additionally statistical information and documents have been used in the analysis.

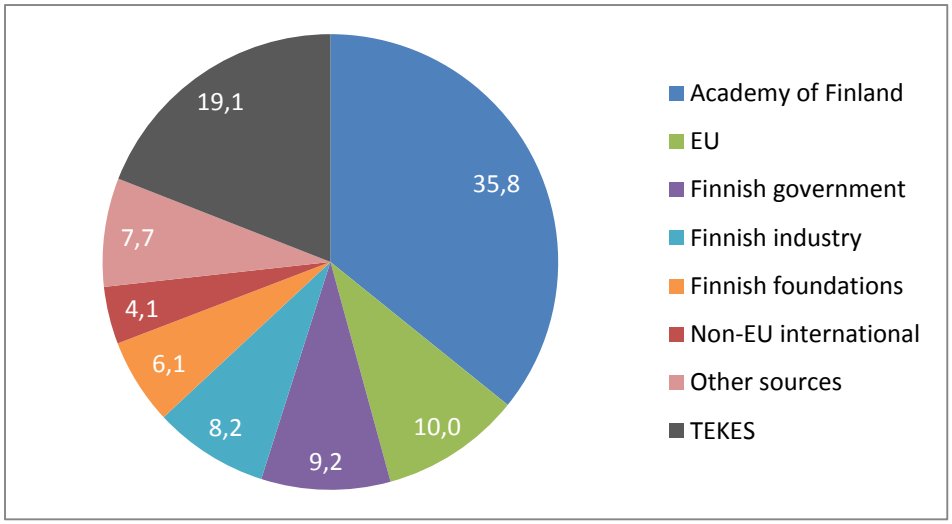
3 Research funding sources in Finland and the UK

Both in Finland and in the UK, the university research funding system operates via two main channels, one providing funding for universities' basic functions and infrastructure and one providing research funding for projects and individuals. In Finland, basic funding for universities is allocated by the Ministry of Education and Culture. Currently this covers around two thirds of universities' total funding (1,8 billion euro in 2012; Ministry of Education, 2013). This funding is allocated through a funding model with indicators in three broad domains of education (41%), research (34%) and other education and science policy goals (25%). In the UK, regional Higher Education Funding Councils (HEFC, for England, Northern Ireland, Scotland and Wales) provide the underpinning infrastructure for research. In 2013–14 HEFCE allocated £1.6 billion to universities for quality-related (QR) research funding. These amounts are determined on the basis of periodic research quality profiling that has operated in the UK since 1986, originally known as the Research Assessment Exercise (last conducted in 2008) and from 2014 replaced by the Research Excellence Framework (REF).

With respect to research funding for projects and individuals, the traditional research council funding is the most important in both countries (Figures 2 and 3; Hughes et al., 2013). These funds are allocated by peer reviewed competitive calls and administered in Finland by the Academy of Finland, and in the UK by seven national Research Councils (RCs). In 2012, Finnish universities received funding of 251 million euros from the Academy which covered 36 per cent of all external research funding at universities (Figure 2).

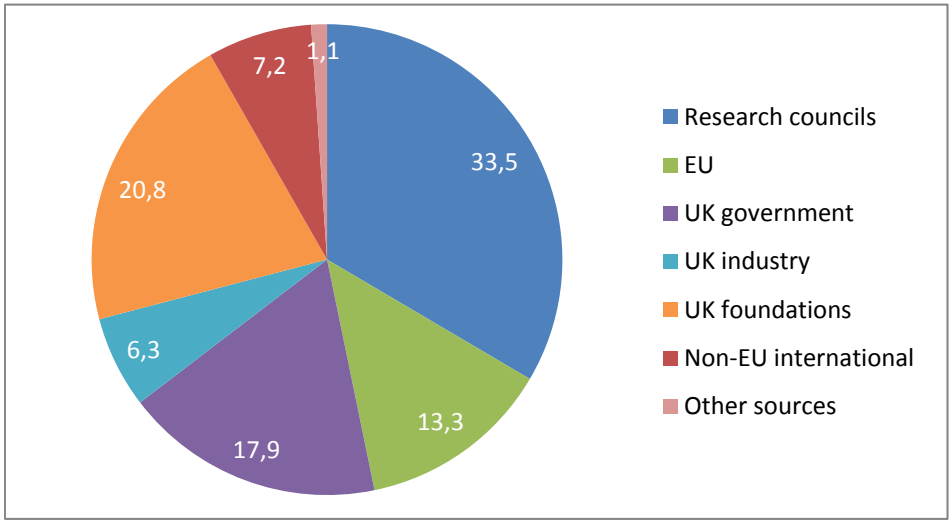
In the UK the seven Research Councils have an overall annual investment in research of around £3 billion (3.65 billion euros) and this covers around one third of all external research funding at UK universities (Figure 3). The biggest difference in the research funding systems, however, is in the area of applied research and development and collaborative R&D. In this area, Tekes is a very important funder for Finnish universities while the Technology Strategy Board is not as significant a funder for UK universities; its funding is in the order of magnitude of around 1% of project-based university funding. Furthermore, funding from charities seems more important in the UK than in Finland. Both in Finland and in the UK the funding systems are increasingly competitive and in international comparison both countries have a high share of university funding via external sources (see e.g. Auranen & Nieminen, 2012).

Figure 2 Project-based research funding at universities in Finland by source of funding, 2012 (%)



Source: Statistics Finland.

Figure 3 Project-based research funding at universities in the UK by source of funding, 2011 (%)



Source: Universities UK.

4 Project-based funding sources and novelty in research

4.1 Basic research council

In Finland, the main funding organisation for basic research is the Academy of Finland while in the UK funding for research for projects and individuals comes from seven national, thematic Research Councils.

The Academy of Finland has several funding instruments with different purposes, intended for researchers at distinct career stages. This funding is highly competitive and the interviewed group leaders considered that competition for Academy funding had recently become increasingly tight and "extremely competitive". This was often associated with the introduction of the full economic cost model in 2009. The model has increased overhead costs in Academy projects and thus increased the budgets of individual projects whilst the total sum of funding available for distribution by the Academy has not increased. Accordingly the number of projects granted funding has slightly decreased. Also the overall success rate of Academy applications has dropped from 40.5% (in 2008) to 30.8% (in 2011) (Arnold et al., 2013). In the latest Academy call in 2013 the success rates for some funding schemes were very low, e.g. for the Academy Research Fellows it was below 10%. Many group leaders interviewed also felt that younger researchers have lost out in this change: as competition increases funding is more likely to go to researchers with more experience and accolades.

In terms of researchers' leeway to define the research problem, Academy funding is considered very free. Furthermore, it is widely seen that the follow-up and monitoring during the project is very loose thus allowing redirection of the research during the project if necessary. This "fund and forget" type of approach to research funding is generally described as very good although some group leaders felt that it leads to a lack of interaction between projects funded by the Academy. In terms of length of Academy funding (normally 3–4 years, some instruments 5 years), it is regarded as relatively good although some group leaders considered there should be longer term funding to allow real risk-taking, failures and redirecting research on that basis. In principle Academy funding has provided continuity for some (most successful) researchers in terms of successive grants but given growing competition for Academy funding, this may only continue to be possible for fewer researchers in future.

Moving into a new research field appears to be very difficult through Academy funding. This is due to the strong emphasis paid to the track record of the researcher in the evaluation of project proposals. With respect to allowing researchers to start completely new research lines to the field, there are diverging views whether (and to what extent) Academy funding would allow that. In practice, evaluators of project proposals are in a key role and many research group leaders interviewed felt that it depends on who happens to be the evaluator.

In the UK, responsive mode research funding for projects and individuals provided by the UK Research Councils was generally seen as a way to have independence and leeway to define one's own research topic and to move into new fields. However due to the discipline-based and consensus nature of the peer review for RCs, novelty generation is limited where grant applicants lack track record in a new field or attempt to move to a different discipline. RC fellowships were perceived as the most attractive, flexible and novelty-supporting funding stream

in the UK. Once again though these are time-limited, as in Finland, and it is unusual for one individual to receive successive support in a fellowship mode. Due to the strategic steer from government, RCs also prioritise particular research themes for several years at a time; these themes may not be relevant to some researchers at one time, and support may dry up for a field at an early stage of development that may take a long time to mature.

4.2 Applied research funding body

In Finland, the main funding body providing funding for applied research and development is Tekes and in the UK the corresponding body is Technology Strategy Board (TSB, funded by the Department of Business Innovation and Skills, BIS).

Recently Tekes funding has been strongly restructured. Among the most important changes have been the establishment of SHOKs[2] (which covered 15 per cent – 85 meur – of all Tekes funding in 2013; Tekes, 2014), closing down of open research calls and initiation of strategic initiatives. Requirements for funding inputs and content steering by companies have also considerably increased. As a result, the conditions, terms and orientation of Tekes funding has changed with important consequences for university researchers. In short, Tekes funding appears to have become more company-relevant, but at the same time, more short-term, less flexible and perhaps less supportive of risk-taking.

Tekes funding appears increasingly company-driven which is particularly visible in the operation of SHOKs. Many researchers feel that in SHOK projects companies are more in charge of defining goals and university researchers need to refocus their own activities into more short-term issues. Furthermore, in other Tekes funding modes firms' influence seems to have increased due to recent changes such as the requirement to have proportionally more company funding in a project. Although there would in principle be leeway for university researchers to define the research problem, the onerous requirement of higher company funding than previously was the case, in practice limits this freedom. This is a significant contrast as compared with the earlier situation when only small 'seed money' was required from companies. This provided university researchers more leeway and allowed them to carry out also more academic projects with Tekes funding. Some group leaders also see that the current situation leads to less risk-taking and more 'conventional' projects as companies are not inclined to invest heavily in higher risk Tekes projects. In practice this means research problems have to be defined from the outset to be most amenable to the companies.

Moreover, interviewed group leaders felt widely that current requirements concerning company funding presented major practical challenges to set up new Tekes projects. It appears very difficult to involve several (at least three) (non-rival) companies and to make them invest in Tekes projects. This seems to be a challenge regardless of the research field.

Tekes funding also seems to have become more thematically predefined and more programme-oriented. This is particularly related to the closing down of open research calls (responsive mode funding). Up until 2012, Tekes had open calls for researchers in public research organi-

[2] SHOKs are Strategic Centres for Science, Technology and Innovation, established as a policy concept in 2007as public-private partnerships which prepare their strategic research agendas and implement research programmes. Major public funding to SHOKs comes from the budget of Tekes. See Lähteenmäki-Smith et al., 2013.

sations where topics were not thematically pre-defined and the requirement for funding contribution by companies was not too significant. Previously many interviewed researchers had strongly appreciated the open calls as they allowed researchers to propose whatever topic they considered important. The increasingly strong thematic and programme orientation is also now reflected in the fact that Tekes funding is widely considered as discontinuous: one theme is funded under one programme then the theme "is shut down". Moreover, also SHOK-funding is described as relatively short-term and as not allowing much longer-term research.

Yet, although researchers' leeway in defining the research problem seems more limited, Tekes funding may provide flexibility by allowing researchers to move into new research fields. This is because (research) excellence and previous publications are not (key) criteria when Tekes applications are evaluated. For starting new lines of research, the strategic initiatives and the FiDiPro[3] projects are regarded as potentially positive funding opportunities and yet researchers currently have little experience with these instruments to confirm whether this is the case. The requirement of company funding was seen as an obstacle in pursuing risky research in Tekes projects. SHOKs were seen as particularly problematic in terms of pursuing novel lines of research.

In the UK, TSB funding was seen as heavily constrained in terms of research topic selection and for composing one's chosen research group. Interviewees were also sceptical of the scientific quality of TSB research, due to the strong steer towards near-term applied research topics from the industry interests involved (and potential policy steer on the industry themes being addressed). A number of respondents also criticised the level of bureaucracy involved in working with TSB funding.

4.3 European Union (Framework programmes)

Much criticism was expressed about the bureaucracy involved in EU projects. Many group leaders have decided not to participate in EU projects any more – or are very critical of participating – due to the heavy administrative procedures and management involved. This view is accompanied by a rather critical perception of the scientific potential and overall benefits of participating in EU projects. Furthermore, the proposal stage in EU projects is considered to be very heavy, work-intensive and requiring resources while at the same time competition is very hard and funding is difficult to get. However, while EU funding is criticised, many group leaders feel that the importance of EU funding is going to increase in the future. This is due to the fact that national R&D funding may decrease while changes in universities' strategies will increasingly highlight the role of EU funding (for instance at Aalto University).

Overall, in EU projects researchers' leeway to define the research problem is considered to be limited: the theme is predefined and call texts create clear limits for setting the research problem. Especially more academic and scientific-oriented researchers feel the original (scientific) research idea sometimes needs to be 'masked' in order to fit the call theme. Some even consider that in EU projects the results have to be "known beforehand" when the project proposal

[3] Finland's Distinguished Professors programme (FiDiPro) is intended to attract top-level researchers from abroad to come to Finland to conduct their research for a longer time period than 'normal' research visits would allow. It is directed at both top-level Finnish researchers working outside Finland and foreign researchers. In practice, it is an instrument for Finnish universities and research institutes to hire top-level researchers from abroad for a fixed period of time. http://www.fidipro.fi/pages/home.php

is being written, directly contradicting the idea of creative, scientific and innovative research. Yet, whilst general leeway is limited in EU projects, it is acknowledged that project coordinators apparently have more possibilities to affect the overall direction of the project whereas partners' clout is substantially smaller in this regard. However, interestingly a few group leaders regard projects funded from EU structural funds as having provided them with significantly more leeway to develop their own ideas and to open up new lines of research.

EU projects are regarded as very strict also in terms of redirecting the research during the project. The projects are tightly structured with often large numbers of milestones and deliverables defined at the start of project. Many researchers feel that the original plan needs to be followed even if difficulties arise that would be better served by redirecting the project in some other way. In this regard, EU projects rather resemble research contracts where project content is predefined and implemented regardless of what happens afterwards.

The possibility for scientific breakthroughs in EU projects is generally considered low. Many researchers question whether anything 'reasonable' can be attained. In particular, large EU projects are considered problematic: consortia are so large that the focus of the project is easily lost and the research effort becomes diffuse. Furthermore, often a large number of (sometimes competing) companies are involved; are they able to participate fully and openly in creative research in this type of setting?

For the UK there were mixed views about the potential for EU FP funding to permit novel research lines and to allow leeway in research topic selection and re-orientation (when needed). Given the applied nature of the fields explored in the UK (multi-disciplinary energy areas, and computer science) some research groups had been successful in winning EU FP funding and the view was that EU FP funding had its place in terms of assisting in finding new international partners, and in accessing research ideas from and sharing research findings with non-academic partners. Like TSB funding in the UK however, where there is non-academic steer of research priorities, UK researchers were sceptical of the scientific quality of EU FP research (and critical of the levels of bureaucracy).

4.4 European Research Council (ERC)

Of all the sources of funding, grants from the ERC were most rarely used among the interviewed researchers: only seven out of 80 interviewed research group leaders reported that someone form their group had received funding from the ERC. This is because ERC funding is very competitive and difficult to get. It also reflects the fact that Finnish researchers have not been very successful in ERC calls: until 2012 the success rate of Finnish applicants was 6 per cent while for the most successful countries the success rate was 23 (Switzerland) and 16 (France and Israel). Out of 29 countries, 14 had better success rates than Finland (Freund, 2012). However, some research groups appear to have been very successful in ERC calls: for instance, one research group in cancer research had over 50 per cent of their funding from the ERC.

Among the interviewed research group leaders, ERC funding is considered very attractive: it is researcher-driven and completely free in terms of defining the research problem. Some consider ERC funding as "the best funding one could get". ERC funding is also considered suitable for starting new research lines, as by definition, ERC is intended for funding risky, break-

through research. It is in practice required that completely new perspectives are probed in order to get funding from the ERC (cf. Luukkonen, 2012).

Many of the UK researchers we talked to had been very successful in winning the full gamut of ERC research funding, with some research groups holding starting, advanced, and synergy grants at the same time. Similar to views in Finland, UK researchers held ERC funding in high regard, believing it permitted work of high scientific quality, that its administrative aspects were light and amenable to mid-project course changes, and that there was leeway to define more 'frontier' research topics for investigation. However a few UK interviewees were sceptical of the potential to get truly novel – and in particular heavily cross-disciplinary – lines of research through current ERC peer review processes.

4.5 Company funding

The availability and use of company funding appears to divide the research fields very clearly. It is very important in chemistry, energy and computer science where most of the interviewed research group leaders had received funding from industry. By contrast, in urban studies and archaeology, industry funding has been practically non-existent. Furthermore, company funding appears to be very prominent in certain fields (and groups) in certain universities: for instance in the energy field in some research groups, even a large part of the PhD theses have been carried out within company projects. Industry funding is considered important in these fields in many respects: it is crucial in that university researchers keep up-to-date with industry developments for instance. Company projects also provide good feedback for university groups, subjects for masters theses, and material for teaching.

Company funding also appears important to provide opportunities for completely new perspectives and initiatives for university researchers. This has been the case, for example, for computer scientists as they cooperated with Nokia during its rise to global market leader in mobile phones. At that time, Nokia continuously faced completely new issues and problems that nobody had resolved before. Collaboration with Nokia brought these issues to the collaborating university researchers, which opened up new research lines in scientific terms. Similarly in energy research and chemistry, company projects bring up issues that are very valuable in scientific terms and may open up new research lines. Some interviewed researchers feel that company projects are far more risk-taking and adventurous than publicly funded projects.

Industry projects are also important in that they are fully-funded by the company. In practice, some surplus may be left in the project which may then be used for other purposes. In this way, "extra" money is poured into the research group through company projects. This extra funding may then be freely used for equipment, travelling or salaries, for instance. In some research groups this "additional" funding from company projects is significant. As a matter of fact, company projects are considered the only type of projects that bring in additional funding and, interestingly, in some university departments, this funding has been crucial for the overall operation of the unit. However, at present the situation is changing as, for example, in Aalto University, university management and the current policy is seen to have taken a negative stand towards company projects. Especially for some industrially-oriented research groups and departments this is particularly contradictory: those projects that bring them additional resources are discouraged by university policies.

Through the additional surplus company projects also provide leeway and flexibility for research groups that have such funding. Yet, in the company projects the researchers' leeway is usually very limited: the funding company also defines the objectives and dictates what will be done and studied. Furthermore, the smaller the company, the more concrete are the needs and the less leeway there is for researchers. Yet, there are some exceptions to this: in some cases, there have been company projects where the company has only provided a broad framework for the project and thus allowed substantial leeway for researchers to operate. Many researchers also highlight that they engage with company projects only if they have a scientific and research-based interest in the topic. Some researchers regard company projects as the most flexible in the sense that companies are interested in the results and are not interested in the way in which the money is actually spent so long as results are delivered.

Yet, for university researchers academic publishing is a challenging aspect in most industry projects. As there is increasing pressure for publishing in all fields, university groups also wish to publish scientific papers on the basis of company projects. Company projects are often short-term, have a quick tempo, and short in duration. This poses challenges for university researchers. Yet, in some cases longer-term company funding has allowed the preparation of PhD theses, particularly in energy research.

In the UK, research funding from industry had some polarised features. On the one hand, interviewees felt there was little to no leeway to define the research topic and, in particular, to have any leeway over the deadline for delivery of research outputs. Industry research topics were also seen to be far shorter-term and applied than those associated with other funding sources. At the same time, similar to this aspect in Finland, industry research funding could have few strings attached when it was in the form of almost honorarium-type support to a particular school or faculty. Use of these funds, albeit small, could then be at the total discretion of a research group leader who could use them to start novel and risky new lines of research, in particular, via one or more PhD students under their supervision. Finally, industry research funding was seen as a way to stay in contact with the state-of-the-art of research applications, and as a source of intellectually stimulating and socio-economically relevant research problems.

4.6 Foundations

Funding for foundations is most important in biomedicine (cancer research) and archaeology where all the interviewed group leaders had had funding from foundations. By contrast, in particular in energy research, the importance of foundations is very limited. A large part of the funding provided by foundations are personal grants or scholarships in which the basic terms and conditions for the researcher (in terms of salary and pension for instance) are worse than in other types of project funding. This is why funding from foundations is not always attractive from the researcher's point of view. As funding from foundations is generally in the form of personal grants and scholarships, especially for PhD candidates, it is relatively small in volume. However, in cancer research there seems to be a different situation as there are larger foundations (e.g. Juselius Foundation) that fund larger longer-terms projects (not individual scholarships). These may be up to 2–3 years, and in some foundations, even five years. The five-year grants are considered very good to allow some stability for the research. Especially in cancer research, foundations provide stability also in the sense that it is possible to obtain

continuation for the project. In some cases, foundations have become very long-term funders for some research groups.

In projects funded by foundations, researchers' leeway is very high. Each foundation normally has its broad focus and relevance areas and perhaps some other conditions, but once the research fits into that area and related basic conditions, foundations tend to provide full academic freedom in terms of the research topic. Thus in principle, foundations are suitable for very risky and novel approaches and may provide funding for completely new research lines. In terms of the flexibility of redirecting the research during the project and other changes in course of the research, foundations have widely varied conditions and practices: some foundations are very flexible whereas others are stricter.

For the UK, at least in the two fields of energy and computing science studied, funding from charities and foundations did not represent a significant proportion for any of the research groups interviewed. However in isolated instances, particular researchers were very satisfied with the significant leeway allowed by even small budgets from foundations, as there were few conditions attached to the funding, and there had been leeway to re-orient the work to account for scientific developments and career progression matters. In other cases, funding from foundations and charities in the UK was viewed in a light similar to support from industry – i.e. applied research topics that needed to be dealt with within a short-term delivery window with little leeway in terms of topic selection or how to specify outputs and deadlines.

4.7 University funds

Universities' internal research funding was used relatively evenly in all the studied fields except for urban studies where its importance was lower. Its significance, however, varied across the universities and it was particularly important at Aalto University and especially in the field of energy research. In practice, universities' internal research funding takes different forms in different universities and at least four funding models can be discerned: 1) large-scale, long-term (5–7 years) research funding programmes such as Aalto Energy Efficiency (AEE) and Multidisciplinary Institute of Digitalisation and Energy (MIDE) programmes at Aalto University, 2) shorter-term (3 years) funding programmes (projects), researcher positions and individual grants, 3) research institutes and centres such as Biocentrum Helsinki or Institute of Biotechnology at the University of Helsinki, 4) 'support packages' for individual researchers.

All forms of universities' internal research funding are considered to be very free and flexible and allowing researchers to follow their own scientific interests. The large-scale funding programmes at Aalto have, however, been thematically restricted to certain fields or topics (e.g. energy, digitalisation). Within these limits, they are regarded as allowing completely free research. Moreover, the large-scale research funding programmes appear particularly important as it is long-term academic funding without heavy reporting and administration duties. Several group leaders described this type of funding as the most important and best funding that is available. While leeway is equally high in other types of internal research funding, they are clearly of smaller volume and shorter term.

While long-term, large-scale funding programmes are typical of Aalto University, the University of Helsinki has tended to support certain research fields by establishing research institutes

and centres (see Tuunainen, 2014). The research institutes provide additional stability and leeway for its staff as their operational model differs from normal university departments. For instance, in the institutes there may be some 'buffer funding' for the research groups: if one group is lacking funding, other groups support it collectively for some time. Institutes also provide new researchers with starting support funds which are completely free and flexible to use.

Many researchers consider that universities' internal (strategic) funding could be the best funding particularly for risky projects, which may not be obtainable from other sources. For example, the Aalto Energy Efficiency Programme is described as a good example of programme that encourages breakthrough research and completely novel approaches.

At the two UK universities studied, basic infrastructure funding for research had been allocated by HEFCE. This provided possibilities for some strategic research management in the form of centrally-determined, internal support for multi-disciplinary, coordination and outward-facing research centre ventures (energy-related research centres at both universities). This block grant derived internal funding can also fund small-scale research by individuals as 'seed corn' support for them to move into new fields. Both of these funding avenues provide leeway for researchers to select their topics and limited possibilities to move into new research fields. With the multi-disciplinary centres this may more likely result in coordination or better exploitation of existing theoretical models and research findings (and these internally-funded centres are time-limited entities unless their budgets are renewed or become self-sustaining from external funding sources).

5 Summary and conclusions

The two following tables summarise the main findings of this study in terms of the different research funding sources and their potential to promote novelty in Finland and in the UK. The tables should be understood as tentative summaries and rough characterisations based not only on the interviewees' accounts, and not as definitive judgements of the different instru-

Table 1 Research funding sources and their potential to promote novelty in Finland

	Leeway		*Stability*	*Move to new field*	*Open new research lines*
	Problem setting	*Redirecting*			
Academy of Finland	++++	+++	+++	+	++
Tekes	++	++	++	++++	++
EU FP	+	-	++	++	+
ERC	++++	++++	++++	++	++++
Company funding	+	-	+	++	++
Foundations	++++	++*	+*	++	+++
University funds	++++	+++	+++*	++	+++

Scale: - = Not at all ... ++++ = Very much.
* = A lot of variation among the funders / instruments.

Table 2 Research funding sources and their potential to promote novelty in the UK

	Leeway		*Stability*	*Move to new field*	*Open new research lines*
	Problem setting	*Redirecting*			
Research councils (c.f Academy of Finland)	+++ ↓	++++ ↑	++ ↓	+	++
TSB (c.f. Tekes)	++	++	+ ↓	+ ↓	+ ↓
EU FP	+	+	++	++	+
ERC	++++	++++	++++	++	++++
Company funding	+	-	+	+ ↓	++
Foundations	++ ↓	++*	+	+ ↓	+++
University funds	++++	++++ ↑	+++	++	+++

Scale: - = Not at all ... ++++ = Very much.
* = A lot of variation among the funders / instruments.
↑↓ = UK differences compared to the respective funding source in Finland.

ments. The most significant difference in the funding sources concerns applied research funding where Tekes is very important in Finland whereas the role of Technology Strategy Board in the UK is insignificant. Furthermore, Tekes funding seems to be more prone to promote novelty whilst the TSB funding is not highly valued in this regard. Another difference concerns the funding from foundations which appear more suited to novelty generation in Finland than in the UK. However, this is probably due to the research fields studied: in the UK only computer science and energy researchers were interviewed and the role of foundations was not that important for those two fields. In this respect the picture may be different if, for example, biomedicine would have been included in the UK data.

On the basis of this study, the following observations can be made concerning the current status of the Finnish research funding system in terms of creativity and novelty in university research:

- **Discontinuity and instability** of research funding is a major challenge for research group leaders. Even the most successful and undoubtedly 'world-class' researchers may face situations where they lack funding and may have to close down their research group.
- The Finnish research funding system **lacks a funder that would strongly encourage risk-taking and novel approaches**.
- The overall **availability of research funding** and different types of funding varies considerably across research fields. For example, archaeology is a field where there is high dependence on only two funding sources quite opposite to other fields. It is to be noted, however, that suitable funding sources per field may vary over time, e.g., a rapid change in the industrial landscape in telecommunications area has reduced opportunities to industrial funding in computer science.
- There seems to be an overall increase of **thematically predefined funding** vis-à-vis free researcher-driven funding. Close attention should be paid to this balance. In certain research fields and universities, it is felt practically impossible to obtain funding for "free", researcher-driven research.

– Research at universities is **practically only conducted through external funding**. Research group leaders have to use increasing amounts of time and energy for securing funding for their groups. In some cases external research funding is also used to support teaching. We could ask whether this situation is sustainable and optimal from the perspective of research groups' possibility to carry out high-level, world-class research.

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