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2019:15

# The policy mix for knowledge transfer between science and industry in Norway

Case study contribution to the OECD Tip knowledge transfer and policies project



Siri Brorstad Borlaug, Silje Maria Tellmann, Liv Langfeldt and Espen Solberg





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# Preface

This working paper presents the findings from a study of the policy mix for knowledge transfer between science and industry in Norway. The working paper was commissioned by the Ministry of Education and Research as a contribution to the OECD TIP knowledge transfer and policies project. The mandate for the study was to carry out a comprehensive mapping of policy instruments and their interactions, based on a template developed by the OECD. The goal of the project is policy learning on how to increase and tighten knowledge transfer between higher education institutions and working life.

We are grateful to the Ministry and the OECD for this opportunity to study different knowledge transfer channels. In particular, we would like to thank our informants at the five case institutions: UiT- the Arctic University of Norway; the Norwegian University of Science and Technology (NTNU); the University of South-Eastern Norway (USN); University of Stavanger (UiS) and University of Agder (UiA). All potential omissions and mistakes in this report are solely the responsibility of the authors.

Oslo, 26.08.19

Espen Solberg  
Head of research



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# Summary

This working paper presents the findings from a study of the policy mix for knowledge transfer between science and industry in Norway. The working paper was commissioned by the Ministry of Education and Research as a contribution to the OECD TIP knowledge transfer and policies project. The mandate for the study was to carry out a comprehensive mapping of policy instruments and their interactions, based on a template developed by the OECD. In limiting this rather broad task, this working paper describes particular instruments targeting knowledge transfer between higher education institutions (HEIs) and industry/public agencies at the level of governance (funding and regulatory instruments), funding agencies and the HEIs themselves. We focus on three formal channels of knowledge transfer: i) commercialisation of research, ii) collaborative research and education and iii) mobility.<sup>1</sup> This summary presents the main findings from the mapping of national policy instruments and the instruments at five HEIs and the (missing) interactions between them.

## Development of the policy mix

Since the beginning of 2000, there has been an increased focus on commercialisation of research from HEIs in Norway, and several national and local instruments have been launched to support the development of patents, spin-offs, and licenses. Also, there has been increased emphasis on collaborative research between HEIs and the public/private sector, seen in the increase in the number of collaborative research programmes and funding of these activities. More recently, the issue of collaboration on education and mobility between sectors have entered the agenda, and we see new initiatives emerging both nationally and at the institutional level.

In terms of the relative importance of the policy instruments, collaborative research receives the largest public budget allocation because this is the channel

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<sup>1</sup>These three channels were selected because commercialisation of research was the focus of the other country studies in the project, and collaborative research and education and mobility are channels characterised by a policy mix, but somewhat less studied – at least in the Norwegian context. Mobility is here understood as instruments that encourage staff to work in both HEI and industry/public agencies.

which involves many HEI staff and employees in the private/public sector. Commercialisation of research is prioritised but a rather small share of HEI staff is involved in this. Mobility issues see rather few national instruments.

Public policy appears to be the key factor of the current policy mix and the main driver of collaboration initiatives. Industry supports cluster programmes and the commercialisation of research through collaborative projects and bilateral agreements with the individual institutions.

## **Governance of the policy mix**

In Norway, the HEIs report directly to the Ministry of Education and Research. Although the HEIs have been granted increased autonomy over the years, their funding relies heavily on direct basic grants from the Ministry. Approximately one third of this funding is allocated through performance-based funding, which makes this a strong instrument in the steering of HEIs. The Ministry of Trade, Industry and Fisheries funds programmes within the Research Council of Norway (RCN) that support the commercialisation of research and research projects in industry. This division of responsibilities between the two Ministries may create barriers for integrating education, research, and innovation.

The mapping shows that the ministries, the intermediary agencies (such as the funding agencies) and the HEIs support the commercialisation of research in the different phases. Intellectual property rights (IPR) ownership was transferred from the academic staff to the HEIs in 2005 to enhance the HEIs engagement in the commercialisation of research. The largest HEIs have taken responsibility and established - or are owners of - technology transfer offices (TTOs) which support the development of spin-offs and assist in applying for funding. This area is less developed at the smaller HEIs. However, commercialisation of research is not an activity which the Ministry of Education and Research supports directly, and apart from the ownership of IPR, there are few financial incentives in this area from the Ministry to the individual HEIs. Nevertheless, the development of spin-offs is primarily supported by public instruments, and the HEI TTOs have relatively good connections with all involved public agencies.

There are several schemes, administrated by intermediary agencies, for collaborative research projects. Participation in these projects mainly depend upon the initiatives of individual researchers/-groups at HEIs or in firms/public agencies. However, large schemes that run for several years, such as cluster and centre programmes – which also involve education, seem to impact the largest HEIs in the way that they plan and coordinate the applications in advance of the calls for these partnerships because they are recognised as important for knowledge transfer.

In more recent years, bilateral collaborative agreements on research and education between individual HEIs and industry/public agencies have become more

widespread instruments for committing to and tightening the relations. These agreements may include goals of curriculum design and teaching, collaborative research, and mobility (both staff and students). The number and scope of these agreements vary considerably between the studied HEIs, and those with a technical profile seem more likely to have such agreements.

In the field of health and life science, collaboration agreements on research and education between medical faculties and hospitals are institutionalised and supported by the Ministry of Health and Care Services. There are, however, few national policy instruments which support mobility between HEIs and industry/public agencies, and these types of instruments are primarily the responsibility of the individual HEIs.

The Ministry of Education and Research requires that all HEIs shall have a Council for cooperation with working life. The councils operate mainly at the strategic level in the institutions, and there are few concrete outputs of their establishment. Anticipated outcomes are, however, increased awareness and mutual understanding between the institutions and their surroundings. Apart from these, most of the studied HEIs have diverse forms of councils on research and teaching, on different levels within the organisation, with representatives from important stakeholders.

## **Current trends**

The performance-based funding of the HEIs does not incentivise the commercialisation of research, collaborative research/education or mobility between HEIs and industry/public sector. Collaborative research projects granted by the RCN and EU count in the performance-based funding model, but the model does not differentiate between collaborative projects and basic research grants. Thus, it supports collaborative research indirectly.

In 2016, the Ministry of Education and Research introduced development contracts to stimulate differentiation in the individual HEIs' profile. The development contracts may involve targets such as commercialisation of research, collaborative research and education and mobility. Per se, it has not yet been decided whether the development contracts shall include funding. If they do, this will incentivise the HEIs to develop and emphasise different channels of knowledge transfer.

Recently, the Ministry of Trade, Industry and Fisheries called for suggestions for instruments that may incentivise researchers to participate in spin-off creation and the licensing of research. A recent report argues that the current practices of IPR ownership at the HEIs should be reconsidered and that a larger share of the ownership should be in the hands of the inventor. The same Ministry has also initiated a review of public agencies and instruments targeting industry development. This review is ongoing include all programmes funding collaborative

research administrated by different intermediary agencies. The aim is to reorganise the system in order to make it more efficient. Results of the review will be presented in 2020.

The Ministry of Education and Research is currently working on a white paper on the relevance of higher education for working life (Arbeidsrelevansmeldingen). The aim is to strengthen the quality and the relevance of higher education through mutually beneficial forms of collaboration with working life.

All three knowledge transfer channels have received increased attention both in white papers and in the development of new instruments and the scaling up or renewal of already existing ones. One recent white paper investigated spin-offs access to seed funding and venture capital and stated that the lack of capital represents a severe barrier for the potential growth of spin-offs. It proposed the establishment of a fund in a fund – a combination of public and private investment, which probably will be realised.

HEIs appear to have a growing consciousness around institutionalising relations with important stakeholders. These steps include, among others, inviting stakeholders to participate in the Board of governors and different councils and committees and to have agreements on bilateral collaboration.

## **Impact, synergies and trade-offs**

An evaluation showed that the transfer of IPR and the introduction of an act relating to the third mission have contributed to institutionalising the TTOs at the largest universities. Despite national policies and a funding scheme for the development of spin-offs and licenses, the results in terms of economic revenues from commercialisations have not been impressive, but there seems to be a tendency for increased quality in reported projects and the estimation of future revenues.

Evaluations of programmes administrated by the different intermediary agencies emphasise that the funding enhance the interaction on research and education between HEIs and industry/public agencies, but that it is difficult to trace or to attribute innovations in industry to specific programmes. Individual researchers or groups are mainly responsible for initiating and participating in research collaboration funded by external agencies. In general, there seems to be less systematic information at the leadership level in HEIs about the extent and content of these collaborations, even though the HEIs report on the collaborations in the steering dialogue with the Ministry of Education and Research. The introduction of development contracts in 2016 may change this situation. Some of them emphasise the HEI's role in regional and national development, and may, as such, push the institutions to engage more systematically in collaboration and support on research and education.

Interviews conducted for this study show that some HEIs perceive bilateral collaboration agreements as significant instruments for knowledge transfer. Mobility schemes where individuals from industry hold additional positions at an HEI are also characterised as successes, in terms of getting access to highly relevant research problems. The academic merit system may, however, represent a barrier for recruiting individuals from industry or the public sector to such positions – at least at HEIs which require a PhD or equivalent.

# 1 Introduction

This report presents the findings from a study of the policy mix for knowledge transfer between science and industry. The study was commissioned by the Norwegian Ministry of Education and Research and is part of an OECD-project organised by the Working Group on Innovation and Technology Policy (TIP). The project aims to “investigate which policies are supportive of knowledge transfer between science and industry and how public policy contributes to innovation”.

Both higher education institutions (HEIs) and research institutes have central - but distinctive - roles in the Norwegian R&D&I system. Therefore, we have chosen to focus on policies and instruments primarily targeting formal channels of knowledge transfer from HEIs and exclude the relatively large and broad research institute sector from the analysis, because the institutes are set-up for knowledge transfer purposes.

Furthermore, we have broadened the scope, from a focus on spin-offs in the OECD project to three main channels of knowledge transfer: (1) Commercialisation (spin-offs, licences); (2) Collaborative research and education; and (3) Mobility.

The rationale for doing so is that the development of spin-offs has already received considerable attention in the Norwegian system and several evaluations of the policy mix have been conducted. Collaborative research and education and mobility between these sectors are more central channels of knowledge transfer for some HEIs, especially those with limited research in the sciences and life sciences. To include different HEIs in the study and to see the different channels concerning one another, we decided also to include collaborative research and education and mobility.

The OECD template calls for an analysis of the interactions between the national and regional level. Currently, the regional level has minor importance in Norway, in terms of instruments for knowledge transfer. We have, therefore, chosen to include five Norwegian universities with somewhat different profiles, to find out how they interact with the national policies.

For each of the three knowledge transfer channels, we describe developments in national policies and instruments and the current situation at five HEIs. We

build upon previous evaluations and reports to map the instruments on the national level, the HEIs' reports to the Ministry of Education and Research on their cooperation with society, and interviews with selected informants at the five HEIs to get their perceptions of the different local and national instruments and the relations between them. In the interviews, we emphasised mobility schemes, in particular, because this is a somewhat under-investigated area.

We do not assess the *impact* of policy instruments or the policy mix on knowledge transfer because that endeavour is a rather complex task, but rather indicate, when appropriate, the potential effects based on previous evaluations of the instruments. We have also excluded instruments targeting student entrepreneurship at HEIs as this area is somewhat outside the scope of the project and would have added considerable length to the report. That being said, it is important to bear in mind that education of students is the main channel of knowledge transfer between HEIs and industry/public agencies.

The report is rather descriptive. It is structured as follows; first, we present the mapping of the national policy instruments for the three knowledge transfer channels. We have divided the mapping into the funding of HEIs; laws and regulations and programmes; and instruments administrated by intermediary agencies. We end each section by describing current trends. The second chapter concerns the five HEIs and their instruments for enhancing the three knowledge-transfer channels. We end the chapter with a discussion of the three knowledge transfer channels.

### **Box 1. Characteristics of the Norwegian R&D&I system**

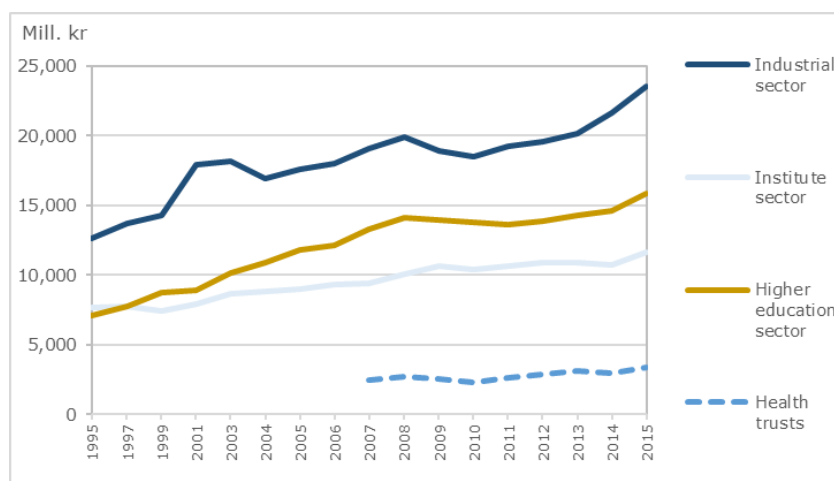
Patterns of STI-knowledge transfer are, by nature, dependent on the structure of the system within which the transfers take place. In this chapter, we, therefore, give a brief overview of the main characteristics of the Norwegian research and innovation system, with particular emphasis on the higher education sector.

#### **Main structure and division of labour**

The Norwegian Research and innovation system (RDI) consist of relatively young institutions. However, since the second world war, and in particular during the last decades, Norway has been eager to adopt best practices from other countries. In some areas, Norway has also been an early mover and a pioneer, for instance, in terms of merging of sectoral research councils, and in introducing performance-based funding systems.

An important aspect is the relatively low share of R&D funding in the business enterprise sector. This sector stands for less than 50 per cent of total R&D funding, compared to around 70 per cent in many other Nordic and European countries. This phenomenon is mainly due to an industry structure where a large share of the value

creation is concentrated in resource-based sectors such as oil and gas and aquaculture, where added value is high and R&D intensity more modest. The figure below shows the development in R&D-expenditure over time and by sector.



**Figure 1.1. Total R&D expenditure in Norway by sector of performance**

*Source: NIFU/Statistics Norway-R&D statistics*

The figure also displays the strong role of research institutes, today accounting for around 20 per cent of total R&D. Even though the relative importance of this sector has decreased since the mid-1990s, a certain division of labour prevails, which means that the role and intensity of universities in science-industry transfer should be seen in connection with the role assigned to research institutes. Furthermore, within health and medicine, the Health trusts play a significant and increasingly important role. This “sector” consists mainly of university hospitals that are partly interwoven with the higher education sector. Altogether, this means that industry-science linkages in Norway involve a more complex set of actors than the university-industry relationships we focus on in this report.

Another aspect to consider is the strong and steady growth of R&D in the HEI sector. This situation is mainly because of a strong increase in the number of students, including doctoral students and correspondingly high growth in resources allocated to both R&D and higher education. Because most HEI-funding in Norway (90%) comes from public sources, of which the most part is basic funding, there is a reason to say that Norwegian HEI-institutions are rather generously funded (see Wendt, Söder and Lehpalahti (2015) for a Nordic comparison). The OECD makes a similar observation in its most recent report on the Norwegian innovation system (OECD, 2017).

The structure within the HEI-system has also undergone significant changes recently. Until around 2010, Norway had a system with a handful of large universities and a rich flora of nearly 30 university colleges. Following an extensive and (in principle) voluntary merger process from 2013, the Norwegian HEI-system today consists of 10 universities and only a few specialised university colleges. This change has also had a bearing on systems for knowledge transfer because the transfer now largely happens within larger and more complex institutions.



## 2 The Higher education system in Norway

Funding of Higher education institutions in Norway is almost exclusively a central state matter.<sup>2</sup> In total, the public funds 90 per cent of Norwegian HEIs' R&D expenditure. This includes general university grants (GU) allocated from the state budget, which in total make up 75-80 per cent of the HEIs' funding and covers expenses related to e.g. administration, education and research. The GU have two components: basic funding in the form of long-term and strategic funds, and performance-based funding. In 2015, basic funding accounted for ca. 70 per cent and performance-based funding for ca. 30 per cent. Performance-based funding is allocated according to a set of indicators – the so-called education and research incentives. There are currently no incentives for innovation-related activities in the funding model, but income from contract research and education will be introduced as a performance indicator from 2017.

The GU comes in the form of block-funding which the HEIs distribute to specific activities. As described above, around 30 per cent is allocated according to a set of performance indicators, but technically the block funding is supposed to be treated as one funding stream. How much each institution dedicates to research and education depends as such upon the institutions' traditions, profile, academic fields and other available funding (Langfeldt et al. 2015).

In terms of total R&D expenditure in HEIs, block-funding makes up 67 per cent. Compared with other Scandinavian countries this is relatively high; Sweden's basic university grants amount to 45 per cent and Denmark's to 57 per cent of the total funding in the HEI sector (Wendt et al. 2015).

In 2015, a white paper on the structural reform was launched (St. Meld. 2015). It stated the ambition of reorganising the higher education landscape by several mergers and the goals were economics of scale, increased quality in teaching and education as well as increases cooperation with working life. Over a short period, 33 higher institutions were reduced to 21 through a wave of voluntary mergers.

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<sup>2</sup> The two first sections are taken from Borlaug et al. (2016)

In light of these mergers and other developments; to ensure a versatile sector and distinct institutional profiles, the Ministry of Education and Research has since 2016 gradually introduced development agreements, running for several years, with each HEI. The overarching goals of these agreements are increased quality in research and education, and they emphasise different knowledge transfer channels. The development agreements and the goals for the period are made in dialogue between the respective institutions and the Ministry. So far, there are no funding attached to the agreement, but it is up for discussion.

## **3 National policies and instruments**

### **3.1 Commercialisation of research**

National policies and instruments for supporting the commercialisation of research from HEIs are mainly found in laws and regulations and in programmes administrated by intermediary agencies. The Ministry of Trade, Industry and Fisheries has the main responsibility for the commercialisation of research results.

#### **3.1.1 Funding of HEIs**

The funding model described above includes teaching and research, but not the commercialisation of research. The HEIs report the number of spin-offs and licence agreements to the Ministry of Education and Research, which has the responsibility for the HEIs. They are, however, not incentivised for these activities as they are for teaching and research. This point has been up for discussion several times, but the conclusion has always been that including commercialisation as a part of the performance-based funding model would favour some institutions over others and would, as such, be unfair as many of the HEIs have a relatively low level of activity because of their research profile.

#### **3.1.2 Laws and regulations**

Like many other countries, Norway emulated the Bayh-Dole Act in the US, which was perceived as a successful policy tool to enhance technology transfer from the universities. In 2003 two amendments were made to the:

- Law on universities and university colleges
- Regulations on intellectual property rights

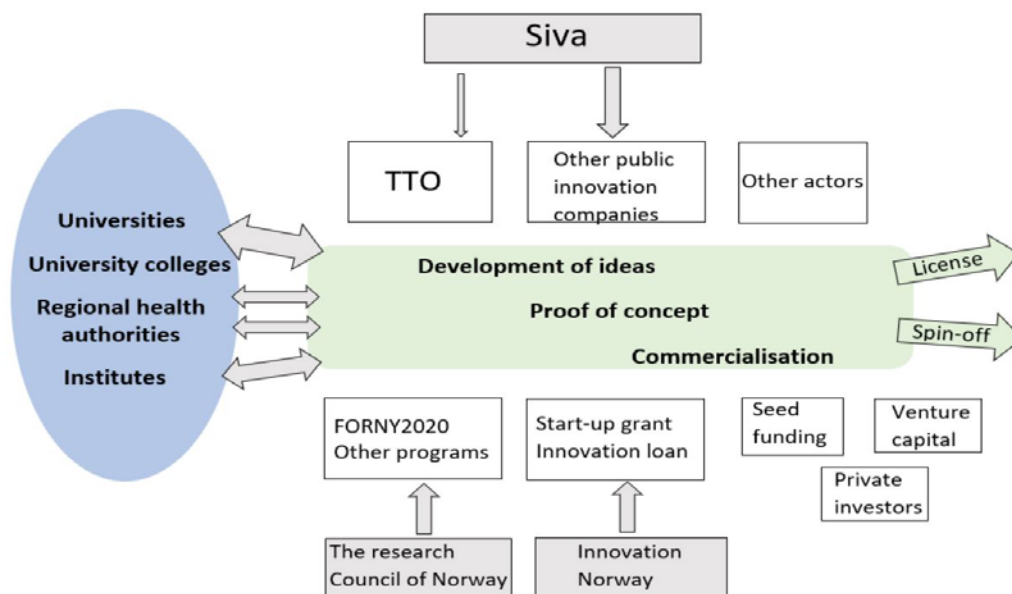
The first amendment ensured the “Third mission” of HEIs by stating that they have the responsibility for disseminating results from research, and for ensuring that

research results are commercialised or used.<sup>3</sup> The second amendment transferred the intellectual property rights from the academic staff to the HEI.

The HEIs have, to various degrees, followed the amendments. An evaluation of the amendments from 2015, showed that the larger universities established their own technology transfer offices (TTO) or had part-ownership in TTOs serving several public research institutions, while the smaller university colleges commercialised their research through other channels - like collaboration projects with industry (Spilling et al. 2015). One of the conclusions from the evaluation was that the TTO function at the five largest universities are well established. In order to institutionalise the function and the practices, the evaluation recommended that the universities should integrate the TTOs more into their core structures and use the TTO's competencies in other areas as well - such as negotiating research collaboration contacts. It also suggested that the TTOs should serve the whole university – not only the academic staff but also the students.

### 3.1.3 Programmes and instruments administrated by intermediary agencies

There are several public instruments for supporting the commercialisation of research. Here, we will describe the most important public intermediary agencies. Their role in the system is illustrated in Figure 3.1.



**Figure 3.1** The system for commercialisation of research

Source: Hansen and Borlaug (2008)

<sup>3</sup>See <https://lovdata.no/dokument/NL/lov/2005-04-01-15>: Paragraph 1-3, d),e)

## The Research Council of Norway

Unlike research funding agencies in many other countries, the Research Council of Norway (RCN) covers all disciplines and research-performing sectors and also provides support for industrial R&D and research-based innovation. It administered several programmes important for developments of spin-offs.

### *FORNY2020*

The Research Council of Norway administrates the FORNY2020 programme which is the main instrument for supporting the commercialisation of research. It got a central role after the amendments, and the majority of the spin-offs developed by the TTOs have received funding from the FORNY2020. Most of the TTOs' activities are registered by the programme because it is one of the main funders of the early-phase of technology transfer. FORNY2020 was established in 1995 and has, after the amendments in 2004, experienced strong growth in grants from the Ministry – from ca 40 MNOK in 2004 to 258 MNOK in 2017.<sup>4</sup> 2016 and 2017 were extraordinary budget years as the Ministry of Trade, Industry and Fisheries increased its allocation substantially as part of the so-called “Entrepreneurship- plan”. We will return to this below.

The FORNY2020 is designed to trigger the value-creating potential of projects conducted at publicly-funded research institutions. Through the TTOs, it provides funding to HEIs for the development of spin-offs and patent applications. The programme funds the following activities:<sup>5</sup>

- proof-of-concept and documentation that the research results can be put into practice;
- preparation of research results from publicly-funded institutions for commercialisation;
- development of research results with commercial potential into attractive investment objects
- development of ideas from students (from 2016).

The programme and its results have been evaluated several times. In general, the evaluations have been rather critical towards the results of the programme, arguing that a large amount of money has been used to support the development of projects, but resulting in few success histories (Borlaug et al. 2009; Rasmussen et al. 2013; Spilling et al. 2015). For instance, Rasmussen et al. (2013) found that approximately 20 per cent of the 474 spin-off companies in the portfolio from 1995 until 2013 had a positive result in terms of growth or being bought by other companies. The majority of these spin-offs were established between 1995 and

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<sup>4</sup>The allocations have decreased the two past years. Due to the financial crises the Ministry increased the allocations temporarily to 258 MNNOK in 2017

<sup>5</sup>Taken from RCNs homepage see: [https://www.forskningsradet.no/prognett-FORNY2020/Programme\\_description/1253963921859](https://www.forskningsradet.no/prognett-FORNY2020/Programme_description/1253963921859)

2005, which illustrates that the way to the market is long. Furthermore, ca 26 per cent were closed down or developments unknown and 29 percent were just registered or sleeping without any activity. The remaining 25 per cent of the spin-offs were active and had significant activity in terms of operating costs, but mostly negative - often common for these types of companies. However, while the evaluations are relatively critical, they are also optimistic about future developments and revenues as they acknowledge that the support system for technology transfer has improved, but the system still lacks the capital to invest in university spin-offs. We will return to this topic below.

Table 3.1 shows the development in number DOFIs (Disclosure of invention), patent applications, license agreements and spin-offs reported by the TTOs.

**Table 3.1 Development of DOFIs, patent applications, licence agreements and spin-offs**

Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016
DOFI	388	623	596	561	684	817	576	902	719
Patent applications			120	135	179	119	190	183	197
License agreements	21	26	27	36	53	54	62	123	124
Spin-offs	27	28	56	50	42	39	42	55	34

Source: Menon 2018

As the table shows, the number of DOFIs, patent applications and license agreements have increased over the years, while the number of spin-offs seems to be relatively stable. Especially the two last years, there have been substantial increases in the number of license agreements, and, in general, the trend seems to focus on licences rather than spin-offs because the latter is perceived as relatively resource demanding in terms of time and finding devoted entrepreneurs.

In terms of sectors, we see that 60 per cent of the commercialisation projects are within ICT (29%) and medical technology/pharmacy/diagnostics (29%), 14 percent within offshore/petroleum, 8 percent within marine/aquaculture, 4 percent within material technology and the remaining 16 percent in “the other” category.

The FORNY programme has been criticised for low flexibility. Calls for proof-of-concept funding that came previously only once a year – now come twice, but still, this number is still considered too little by the TTO because many projects demand funding that may be long-term rather fast in order to keep the enthusiasm and engagement of the researcher. For instance, if a researcher reports a DOFI immediately after the deadline for applications, the researcher may have moved on to other projects or even changed jobs in the meantime. However, measures have been taken by both the RCN and individual HEIs. Based on competition between the TTOs, the RCN allocates so-called local project funding dedicated to early

proof-of-concept to the TTOs, and some HEIs have established their own preliminary proof-of-concept funding for which both researchers and students may apply (Spilling et al. 2015).

In the same evaluation, the programme was criticised for targeting scientific staff only, omitting students who are often willing and have the possibilities to become entrepreneurs and take risks. In 2016, the FORNY programme introduced the instrument STUD-ENT, targeting master's students at HEIs. The students need the support of their HEIs and may get max1 MNOK (ca 100 000 €) a year based on a national competition. In 2018, 25 per cent of the applicants got funds.

#### *Other research grants*

The spin-offs that have received support from the FORNY, usually also receive funding from other public sources, such as other programmes administrated by the RCN. In the period from 2005-2014, there were 168 FORNY-spin-offs involved as partners or heads of projects in 487 research projects funded by RCN. In sum, the projects have received 2.3 billion NOK, which is a considerable sum. Note, however, that the projects often have several partners and run for several years (Spilling et al. 2015).

Furthermore, the RCN administrates some large-scale programmes, like BIO-TEK2021, which, in addition to funding research, also has so-called “optimisation funds” (per se the only programme, but the aim is to include this type of funding in other programmes as well). The first call came in 2012, and the purpose of the funding is to support research and development of biotechnology products, processes, and services that have commercial potential, and where there is a need to develop and conceptualise the technology in order to adapt it to commercial use. During 2013–2016, around 50 optimisation projects received funding with approximately 290m NOK (Technopolis 2017).

#### *The SkatteFUNN R&D tax incentive scheme*

SkatteFUNN is also administrated by the RCN. It was established in 2002 and is designed to stimulate R&D in Norwegian trade and industry. Businesses and enterprises that are subject to taxation in Norway are eligible to apply for tax relief. Approved projects may receive a tax reduction of up to 20 per cent of the eligible costs related to R&D activity.<sup>6</sup>

Since 2002, the scheme has grown considerably, and in 2016, 7000 projects were given tax relief of approximately 5 billion NOK. In the period from 2005-2014, 65 per cent of the FORNY spin-offs got tax relief which together amounts to 1.1 billion NOK.

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<sup>6</sup>For further information see: [https://www.forskningsradet.no/prognettbiotek2021/Sentrale\\_dokumenter/1253970728198](https://www.forskningsradet.no/prognettbiotek2021/Sentrale_dokumenter/1253970728198)

An analysis from Statistics Norway (2016) showed that SkatteFUNN has in effect, in general, for all firms granted increased value creation by 1.8 million NOK and contributed to two new jobs per 1 million NOK in tax relief. For spin-offs, the value creation is somewhat lower – 800 000 NOK per 1 million in tax relief.<sup>7</sup> A second evaluation in 2018, was also positive and concluded that the scheme contributes to increasing firms' investment in R&D which gives more innovation and productivity.<sup>8</sup>

#### *Innovation Norway*

The FORNY-spin-offs also capitalise on programmes administered by other intermediary agencies. Innovation Norway, owned by the Ministry of Trade, Industry and Fisheries, administers several programmes, which support the early phases of the commercialisation process. The main sources are “start-up grants”, “innovation contracts”, “innovation loan”, “commercialisation grant” and “environmental technology grant”. Nearly all FORNY spin-offs have start-up grants, and two-thirds have innovation contracts, which is the largest funding source. In the period from 2005-2014, 218 MNOK was distributed through innovation contracts, which is about half of all funding for the spin-offs from Innovation Norway (Spilling et al. 2015).

#### *SIVA- the company for industrial growth*

The FORNY spin-offs also use facilities that are supported by the public enterprise SIVA, also owned by the Ministry of Trade, Industry and Fisheries. Since SIVA supports incubators where spin-offs are given office space and access to professional mentors, investors, and business developers, the support is more indirect. They also support spin-offs through investment funds, which are administered by the incubators. We will return to this subject below in where we describe the local systems for supporting spin-offs.

#### *Public seed capital funding*

One recurrent criticism of the system has been the lack of seed-capital - both private and public. As shown above, substantial financial resources are invested in the development of spin-offs, but these are not sufficient to cover the years of capital-intensive development before any commercial income can be expected, which is typical for university spin-offs. In Norway, there have been three generations of public seed capital funds in the period 1997-2015 (NoU, 2018). The goal of a seed capital fund, as for other investment funds, is that the company can be sold with

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<sup>7</sup><https://www.ssb.no/virksomheter-foretak-og-regnskap/artikler-og-publikasjoner/stor-okning-i-bruk-av-skattefunn-ordningen>

<sup>8</sup>Samfunnsøkonomisk analyse (2018) Evaluation of SkatteFUNN. Report 18-2018.



profit, after a certain period.<sup>9</sup> A revision of the first generation of funds showed that they did not manage to invest in and develop viable companies, and the state had a considerable loss on these funds. These were four regional funds, and they were wound up in 2013. Note, however, that the funds were new and thus the expertise and competence to manage them relatively marginal.

In 2006, the next generation of funds was established. One part of the funding was aimed at knowledge intensive companies, in districts characterised by low business intensity. The other part covered the whole country, but different sectors; i.e. ICT, oil/gas, renewable energy, materials- and process technology, biotechnology/pharma and marine technology. Innovation Norway administrated the practical issues, and the funds were owned by the Ministry of Trade, Industry and Fisheries.

In 2012, the third generation was established, and like the second generation, these covered the whole country and specialised in specific sectors. The criticism – referred to above- has been that the funds may be characterised as risk-averse because they invest in mature companies. One reason for this fact has been that the Ministry have primarily monitored the activity through financial reports, disregarding other types of developments and potential impacts.<sup>10</sup>

#### *Public venture capital funds*

In addition to these funds, there are two large public venture capital funds - Argentum and Investinor. The first invests in the private equity market, and the latter, fully owned by the state, invests directly in companies, and some of these investments are into so-called FORNY companies. Today, Investinor has total assets amounting to 4.2 billion.

### **3.1.4 Current trends**

Recently, the Government and different commissions have emphasised the importance of the commercialisation of research results for economic growth and development. In 2015, the Government launched an entrepreneurship plan which stated that it needed to strengthen the entrepreneurship culture at HEIs. The goal was to increase the economic revenues and value-creation from publicly financed research by stimulating HEI researchers to commercialise their research.<sup>11</sup> With the plan came increased funding to amongst other programmes in RCN, especially

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<sup>9</sup>Kapitalutvalget (NOU2018:5) <https://www.regjeringen.no/contentassets/62f6dd4e0274432da6475e53f4b14d44/no/pdfs/nou201820180005000dddpdfs.pdf>

<sup>10</sup>Dokument 3:8 (2015–2016) Riksrevisjonens undersøkelse av såkornfondenes resultater

<sup>11</sup> Nærings- og fiskeridepartementet (2015). Gode ideer – fremtidens arbeidsplasser. Regjeringens gründerplan.

the FORNY-programme and Innovation Norway, and part of the growth was earmarked for the STUD-ENT scheme. In 2016, the so-called Productivity Commission which investigated the potential for economic growth and increased productivity in all sectors also emphasised the importance of the commercialisation of research for economic growth and called for incentives for the HEIs to support commercialisation.<sup>12</sup>

Following this plan, the Ministry of Trade, Industry and Fisheries commissioned a report to investigate different forms of incentives for the commercialisation of research. Economic incentives through performance-based funding were not discussed; neither was incentives through the career system which is based on research and educational activities. The report advised the HEIs to give a larger share of the income or ownership in the spin-offs to the inventor or the inventor's research group. Hitherto, it has been common in most TTOs to divide the ownership and the income into three equal parts between the inventor, the TTO and the HEI. The report argues that a larger share for the researcher may give an increased incentive to engage in spin-off development which is perceived as consuming considerable time and resources, often taken from research and work with scientific publications (Menon, 2018). Another issue is that that this scenario will give the researcher control over the spin-off, a factor often seen by other investors and venture capitalists as important.

The previously mentioned White paper on Capital comments that it is demanding to secure financing in the early development phase for potential growth companies and the amount of equity capital being channelled to promising early-stage companies is inadequate. Such companies are both in need of venture capital and, in particular, relevant competence on the owner side. The Commission, therefore, suggested that the State facilitate early-stage investments in order to secure access to long-term, competent capital and competent owners, and recommends that the State allocate NOK 1 billion to a new, flexible fund with a venture mandate, to be invested over three years.

The Commission further recommended giving seed capital funds national and flexible mandates, facilitating more stable access to capital for relevant portfolio companies, and transferring the responsibility for following up this funding from Innovation Norway to a professional investment management community.

## 3.2 Collaborative research and education

Collaborative research projects funded by a third party – i.e. funding agencies, or contract research are one of the main formal channels of knowledge transfer

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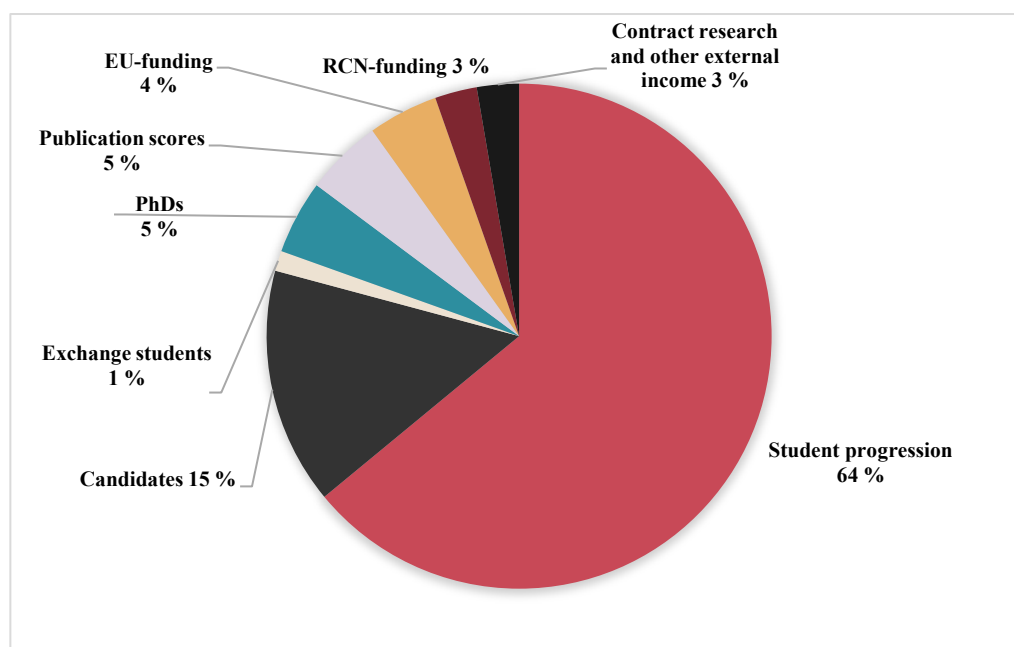
<sup>12</sup> The Productivity commission (2015). Productivity – foundation for growth and welfare. NOU 2015:1.

between the sectors and are important for research and innovation (Meyer-Krahmer & Schmoch, 1998; Perkman & Walsh, 2007; D’Este & Patel, 2007). In the following, we will first describe national instruments for stimulating collaborative research and thereafter address education.

### 3.2.1 Funding of HEIs

As mentioned above, funding of HEIs in Norway is almost exclusively a central state matter, and the Ministry of Education and Research has this primary responsibility. Performance-based funding makes up approximately 30 % of the block funding given to the HEIs. Figure 3.2 shows how this funding was distributed in the 2018 budget, according to the relative importance of performance indicators.

As the figure shows, most performance-based funding is allocated according to the two main types of indicators 1) education incentives and 2) research incentives. The research indicators reward all types of grants from the RCN and the EU, in addition to scientific publications (Borlaug et al. 2016). They do not specifically incentivise collaborative research projects between HEIs and public/private actors, apart from the incentive for contract research and other external funding, e.g. further education and training programmes (the so-called BOA-indicator). This incentive is however rather weak because it accounts for only 3% of total performance-based funding. Its behavioural impact is also unclear because the incentive was first introduced in 2017.



**Figure 3.2** Relative distribution of HEI performance-based funding in 2018 by performance indicators.

Source: Ministry of Education and research (*Blå bok*, 2018)

### 3.2.2 Laws and regulations

The Act relating to Universities and University colleges (§ 1-3 h) states that an institution should collaborate with other universities and university colleges, in other countries, local and regional social and working life, public sector and international organisations.

This mandate means that the HEIs have a responsibility to collaborate with the public and private sector on both educational and research activities.

### 3.2.3 Programmes and instruments

Two main national agencies fund collaborative research – The RCN and Innovation Norway. In addition to these, the national agency SIVA have the primary responsibility for physical infrastructure and some schemes.

#### *The Research Council of Norway*

The RCN administrates the majority of grants that integrate collaboration between universities and the private/public sector. Over the last five years, the allocation of funding from the RCN to firms has increased ca. 45 per cent (from 1137 MNOK in 2013 to 1645 MNOK in 2017), and the allocation of funding to industry-relevant research has also increased ca. 41 percent (from 3223 MNOK in 2013 to 4541 MNOK in 2017). In the same period, the tax reduction scheme SkatteFUNN (see above) increased its budgeted reductions 158 per cent (from 2155 MNOK in 2013 to 5569 MNOK in 2017).<sup>13</sup> SkatteFUNN includes a collaborative part where firms collaborate with research institutions – both HEIs and research institutes. In economic terms, the SkatteFUNN constitutes the largest public instrument for stimulating R&D investments in Norwegian companies

Apart from the SkatteFUNN, the main collaborative research programmes at the RCN are:

- Centre for Research-based Innovation (SFI) and Research centres for Environmental-Friendly Energy (FME), which offer substantial funding over eight years to research groups that collaborate with public/industrial partners.
- Large thematically oriented programmes within, e.g. ICT, bio- and nanotechnology, renewable energy, ocean, food and bio-economy, petroleum and gas.
- User-driven research-based innovation (BIA) funds industry-oriented research and has no thematic restrictions.

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<sup>13</sup>Research Council of Norway. Annual report 2017.

### *Innovation Norway*

Innovation Norway organises the cluster schemes with support from Siva and the RCN. The schemes' goals are to increase the cluster dynamics and attractiveness, the individual company's innovativeness, and competitiveness. The schemes target companies, in particular, but the clusters also include research institutions. The scheme also receives support. There are three different schemes:

- **Arena:** These immature clusters are in an early phase, with different preconditions and potentials. Arena funding is provided for 3-5 years.
- **Norwegian Centres of Expertise (NCE).** These mature clusters have an established national position. NCE funding is provided for ten years.
- **Global Centres of Expertise (GCE).** These mature clusters have a global position. GCE funding is also provided for ten years.

The cluster-programmes have four strategic priority areas:

- Cluster development.
- Knowledge cooperation; develop cooperation with national and international HEIs and other public research organisations on research, development, and education.
- Innovation cooperation; cooperation projects between cluster members.
- Cluster to cluster cooperation; cooperation across sectors and technology areas nationally and internationally.

### *SIVA*

In collaboration with Innovation Norway and RCN, SIVA administrates a relatively new scheme; Norsk katapult (Norwegian catapult).<sup>14</sup> The aim is to provide a common infrastructure for companies and research institutions for testing, visualising, and simulating new technologies, products, processes, etc. Five centres are established within the areas of oceans, manufacturing, digitalisation, future materials, and maritime operations. Some of the clusters host the centres.

## **3.2.4 Education**

Collaboration on education can take a number of forms, ranging from student mobility to curriculum design, curriculum delivery or lifelong learning (Davey et al. 2018). As shown above, there are several instruments in place for stimulating collaboration on research activities. While some of these also include education (e.g. the centre and the cluster schemes), there seems to be relatively few instruments

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<sup>14</sup><https://norskkatapult.no/>

targeting education in particular. Collaboration on education activities seems to be primarily a task for the institutions themselves.

That being said, it is important to note that higher education institutions offering professional studies (e.g. teaching, health professions) already have close collaboration with schools and hospitals on the education of students. These study programmes follow the national curriculum, which demands that all students have to get on-the-job training. In these fields, there is a close and institutionalised relationship between HEIs and working life (albeit the quality on these relations may differ).

To our knowledge, two national initiatives have been launched with the specific aim of increasing the collaboration on education. In 2011, the Ministry of Education and Research imposed the idea that all HEIs should establish councils for cooperation with working life (Råd for samarbeid med arbeidslivet – RSA), including both internal and external members from relevant sectors. This was based on a white paper in 2008 (St. meld. 2008-2009) which stated that the relations between the HEIs and working life were weak and needed to be strengthened. The motivation behind the establishment of RSA was to facilitate the cooperation between education and working life and make these relations more structured and better rooted in the institutions' plans and strategies.

While the RSA's were originally motivated by concerns over the relevance of study programmes to working life, an evaluation of the arrangement (Tellmann et al. 2017) showed that many of the institutions have extended the mandates of the councils to cover collaboration on research and innovation, which indicates that the institutions want to use the RSAs as an arena for collaboration in a wide sense. However, the councils operate mainly at the strategic level in the institutions, and the evaluation displayed few concrete outputs of their establishment. Anticipated outcomes are, however, increased awareness and mutual understanding between the institutions and their surroundings.

Another initiative was introduced by the Ministry of Local Government and Modernisation in 2013. "Competence development in regional industry", administrated by Innovation Norway, supports strategic cooperation between regional industrial actors, HEIs and vocational schools to develop study programmes and continuing learning courses addressing the competence needs of the industrial actors. The programme is relatively small, and seems primarily oriented towards funding and strengthening existing clusters (see above).

### 3.2.5 Current trends

Recently, the Ministry of Industry, Trade and Fisheries initiated a comprehensive review of public agencies and instruments targeting industry development.<sup>15</sup> All instruments described above are part of this review. The goal is to establish a knowledge base for policy reforms, as well as structural reforms, including more efficient instruments and better task division between the public agencies managing them, and ultimately better ensure that the public funding generates value-creating and economically-viable jobs.

The review will include issues such as how to achieve clearer responsibility and task sharing between the state and county authorities, as well as easy use of instruments and good interactions between instruments at local, regional, national and international levels. The competencies in the relevant agencies will be reviewed, and reallocation of instruments considered to the most competent agencies. Simultaneously, the counties will be strengthened as policy actors, and particular attention will be paid to the location of instruments related to small businesses and local/regional purposes, such as incubators, business gardens, mentoring programmes, corporate networks and entrepreneur grants. A recent government report on the future tasks of counties suggests a transfer of half of the grants to industry-related research from the RCN to the counties in order to strengthen the regional level. This suggestion has generated considerable debate, and some opponents claim that such a transfer would reduce quality and impair the competitiveness of Norwegian industry and increase administrative costs. The review of the agencies and the instruments is supposed to be finalised in 2020, and it might have consequences for the funding of collaborative research between HEIs and industry.

Currently, the Ministry of Education and Research is working on a white paper on the relevance of higher education for working life (Arbeidsrelevansmeldingen). The aim is to strengthen the quality and the relevance of higher education through increasing the collaboration on education; to increase the quality of the on-the-job-training in profession studies; to strengthen the ties between education and working life in fields that are characterised by weak relations; to emphasis innovation and entrepreneurship in higher education.

## 3.3 Mobility

The mobility of personnel between academia and industry or public sectors has received increased attention over the past years as a way to facilitate knowledge

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<sup>15</sup>For further information see: <https://www.regjeringen.no/no/aktuelt/starter-arbeidet-med-arydde-opp-i-virkemiddel-jungelen/id2612290/>

exchange and, thus, the transfer of knowledge and competence between sectors. This idea is founded on the recognition that knowledge transfer takes place in a complex web of interactions between people and that research skills and research-based knowledge are largely tacit and, thus, person bound. In this context, mobility is broadly outlined as “knowledge transfer through people” (Hristov et al. 2016:7).

Mobility may, however, take many forms and is not an agreed-upon concept for policy development. In their study of mobility and knowledge transfer, Iversen et al. (2014) examined researchers’ change of position from one sector to another, and they distinguish between inflow and outflow mobility. Such an exchange is, however, largely dependent on labour market conditions, and less on policy instruments for mobility. Moreover, the exchange of knowledge is presumably mostly one-way. In their study of intersectoral mobility and knowledge exchange, Hristov and colleagues (2016) take as a starting point the staff in higher education institutions, and they include both 1) staff exchange, 2) joint supervision of doctoral researchers, and 3) the setup of university spin-offs as schemes that facilitate knowledge through the mobility of personnel. According to this thought, mobility may occur without people having to change position. These forms of mobility are, accordingly, more feasible as objects for national policy development in the higher education sector.

Recent mapping of national schemes for mobility for knowledge transfer between academia and the field of practice (including both industry and public sector) in a selection of European countries found, however, that few national structures facilitate this kind of mobility (Frølich et al. 2017). Only Finland has introduced a system for practice professors, where people from the field of practice with special competencies may be awarded professorships for special purposes without having the formal academic qualifications. One barrier to the establishment of such schemes in Norway is the qualification requirements of academia because a PhD or equivalent is required to enter academic positions. National policies for appointments in the higher education sector does not, however, prevent institutions from employing people without a PhD or equivalent in non-academic positions. Accordingly, single institutions may establish schemes and structures that open to intersectoral mobility. This situation is also the case for joint supervision of doctoral researchers. While national guidelines claim that main supervisors should hold a PhD or equivalent, single institutions may facilitate joint supervision with co-supervisors without a PhD.

### **3.3.1 Funding of HEIs**

Recently, as part of the dialogue between the HEIs and the Ministry of Education and Research, development contracts have been introduced. These contracts are between the individual HEIs and the Ministry for four years to contribute to the



development of the institution's profile. Some HEIs have, as a part of their contract, the goal of developing mobility schemes. Per se, there is no funding attached to the development contracts. The issue is currently up for discussion. If funding would be attached to the contracts, then intersectoral mobility will be included as part of the performance-based funding for some HEIs.

### **3.3.2 Laws and regulations**

Norway has a long-standing tradition for adjunct professors and additional posts, which are positions that are limited to up to 20% of a full-time position and awarded to people without open competition for a limited period of time. The use of such positions is regulated by the Norwegian Act relating to Universities and University colleges. People are employed in adjunct positions because he or she has acquired skills or qualifications that the institutions need, and the positions are accordingly designed to facilitate knowledge transfer through mobility. While these positions originally were introduced to facilitate intra-sectorial mobility – mobility within academia – they can also be used for intersectoral mobility. This point has been particularly evident in health-related academic institutions, where people also often combine clinical and academic positions.

### **3.3.3 Programmes and instruments**

A more recent development is the introduction of the industrial and public-sector PhD-scheme, administrated by the RCN. Under these schemes, companies or public organisations may apply for support for three years for an employee seeking to pursue an ordinary doctoral degree. The doctoral candidate must be employed by the company/organisation, and the doctoral research project must be of clear relevance to the company's/organisation's activities. The schemes are developed to spur greater interaction between academia and society at large, specifically to encourage knowledge transfer from researchers to society and build the research competence and capacity in firms and public agencies. The Industrial PhD scheme was introduced in 2008 and is funded by the Ministry of Trade, Industry and Fisheries. It received a positive evaluation in 2012 and had, at that point, financed more than 150 PhD students. The Public sector PhD scheme was introduced in 2014 and is funded by the Ministry of Education and Research. Both schemes are administrated by the RCN.

The RCN has recently (2016) established a so-called "Researcher pool" to ease access to researcher competence for firms applying for SkatteFUNN (tax reduction). Researchers from HEIs and research institutes sign up on a list and describe

their competence. Per se, this programme is only available in the fields of ICT and tourism.<sup>16</sup>

A more institutionalised scheme is “competence brokering”. The RCN funds individuals who discuss ideas with firms and help them to find the right researchers in public research institutions. The aim is to stimulate more companies to use research in their innovation work.

### 3.3.4 Current trends

As already outlined above, several stakeholders have argued for strengthening the links between HEIs and industry/public sector by introducing new types of positions at HEIs. Mobility is one area that has got increased attention past years and positions such as a practice professors have been warranted by, e.g. the Confederation of Norwegian Enterprise (NHO). It seems that the suggestion will be turned down because the name ‘professor’ requires academic merits.

## 3.4 Summing-up

In summing up this chapter, table 3.2 provides an overview of the main national policy instruments for the three knowledge transfer channels.

**Table 3.2 National policy instruments for knowledge transfer**

Policy instruments	Commercialisation	Collaborative research	Mobility
Funding of HEIs	Not included in the performance-based funding system	Indirectly included in the performance-based funding system	Not (yet) included
Laws and regulations	IPR-ownership transferred from staff to institutions	Within HEIs mandate	Adjunct professors and additional positions regulated by law
Programmes and instruments	Different agencies and programmes support development in different phases	Several programmes/schemes administered by intermediary agencies	Few programmes

As in many other countries, several policies and instruments for enhancing the commercialisation of research have been introduced the two last decades. The responsibility for these policies and instruments are located in two different

<sup>16</sup><https://www.skattefunn.no/prognostikk-skattefunn/Artikkel/Forskerpool/1254021760815?lang=no>

ministries; the Ministry of Education and Research which governs the HEIs and emphasises research and educational activities in the steering dialogue, the Ministry of Trade, Industry and Fisheries are responsible for funding support structures for the commercialisation of research and general programmes supporting collaborative research. Such a division of responsibilities may be a barrier to a coherent governing of HEIs and their activities, resulting in weak integration of commercialisation activities and collaborative research into the daily operations of HEIs (Borlaug et al. 2016).

One step on the road has been the amendments to the act emphasising the Third mission of HEIs and a transfer of IPR from academic staff to the institutions. This point contributed to the institutionalisation of the TTOs at the largest universities and to increased funding of the FORNY programme which supports the proof-of-concept and verification phases and the work of the TTOs. Several government agencies contribute to the development of spin-offs, and, as the above shows; a significant amount of money has been invested. Altogether 3.9 billion NOK (excluding seed and venture capital) over nine years.

In general, the collaboration between the different intermediary agencies in the system is good, and they have distinct roles. The TTOs report, however, that they may get a fast track in applying for funding from Innovation Norway, because the commercial potential of the projects already has been evaluated by them, in other words, the actors in the public system should trust the competence of the others. This admission may save time for the entrepreneurs.

Another bottleneck in the system seems to be the control of IPR by the TTOs and HEIs. While the transfer of the IPR was meant to commit the HEIs to provide for and engage in the commercialisation of research, the current practice of dividing the ownership of the IPR into three parts, where the entrepreneur/researcher only controls one third of the stocks seems to offer a challenge for the entrepreneur in the process of attracting investors. At the system level, access to seed capital is also a challenge. If the proposed fund in the fund is realised this change may contribute to lowering this barrier.

The chapter further shows that several programmes administrated by the intermediary agencies target collaborative research, but rather few national policy instruments have been developed for increasing mobility between HEIs and industry/public agencies. Two exceptions are schemes at the PhD. Level, and instruments such as 'competence brokers' which are persons located in a research/industry park which mediate between HEIs and industry. The HEIs have, the autonomy, however, to create new positions for intersectoral mobility themselves, as we will show in the next chapter.

The higher education sector is a key target group of national policies and instruments for knowledge transfer and the commercialisation of research. Moreover, higher education institutions have themselves developed and launched a

range of different initiatives and instruments to arrange for knowledge transfer and interaction between the institutions and external actors in both industry and the public sector. By mapping the instruments and initiatives of strategically selected institutions, this section will illustrate the scope and diversity of the institutions' activities for knowledge transfer, as well as the different structures and actors involved.

## 4 Higher education institutions in Norway

The higher education sector in Norway is divided into five different institutional categories: universities, university colleges of applied sciences, specialised university colleges, private colleges and academies of arts. In terms of R&D Expenditure and a number of academic staff, universities are by far the largest subdivision of the higher education sector. This fact is a heritage of the traditional division of labour in the sector; with universities being more research intensive, and the university colleges having a larger responsibility for the training of vocational professionals and for contributing to regional needs. The landscape of the sector has, however, changed markedly over the past ten years due to a wave of mergers between higher education institutions. The mergers aimed to increase quality in higher education and research by spurring a stronger concentration and division of labour in the sector. Per January 2019, there are ten universities, five specialised university colleges and six university colleges in Norway. Also, there are 17 private institutions with state funding.

The mergers have resulted in larger institutions, with a broader geographical, as well as disciplinary, scope. In the process of merging, the institutions have consequently revised their strategies in order to carve out new strategic profiles based on their combined merits and adapted to their academic and societal role in the education and research system as well as their renewed role in their region.

### 4.1 Institutional governance

The governance of higher education institutions in Norway is regulated in the Act relating to Universities and University colleges. Their supreme authority is the institutional board, and a rector can be either appointed or elected. In cases where the rector is elected, she/he is also chairman of the board. In cases where rector is appointed, the Ministry will appoint an external chair. The further members of the board consist of a combination of members of the staff and students, as well as at least four external members. The external members should be recruited on the basis of representing relevant industry, cultural or societal institutions, and it is

assumed that board members should have complementary competencies. The external representation on the boards is considered to be an important means to strengthen institutions' relations towards the external environment (Borlaug et al. 2016).

The main tasks of the board are to draw up the strategy for the institution's education and research as well as related activities and to determine the objectives and performance requirements of the institution, as well as the disposition of the institution's financial resources. In drawing-up strategies and objectives of the institution, the board is expected to include knowledge transfer initiatives and activities.

## 4.2 Higher education institutions and knowledge transfer

Norwegian HEIs have a three-legged mandate in the Act relating to Universities and University colleges. In addition to the conduct of research and teaching, universities are expected to "Disseminate knowledge of the institution's activities and promote the understanding and application of scientific and artistic methods and results in public administration, cultural life and business and industry".<sup>17</sup> Institutions enjoy broad autonomy regarding how this task should be met, yet a menu of national soft policies and instruments for knowledge transfer, as we have shown above, are targeted at units and actors from the HEI sector. Many knowledge transfer initiatives and activities in HEI's, are accordingly the offspring of national instruments, and are, consequently, dependent on national support.

## 4.3 The scope of mapping and case selection

The annual reports of selected institutions for the year 2017<sup>18</sup> was used as a starting point for a mapping of institutions' schemes and systems for knowledge transfer. The scope of this survey of the annual reports has been to identify institutions' local initiatives and activities for collaboration with external actors and organisations, as well as support and implementation of practices for knowledge broker arrangements. The initial mapping is complemented with studies of other reports and documents that can inform the researchers about the institutions' schemes and activities.

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<sup>17</sup>[https://www.regjeringen.no/globalassets/upload/kd/vedlegg/uh/uhloven\\_engelsk.pdf](https://www.regjeringen.no/globalassets/upload/kd/vedlegg/uh/uhloven_engelsk.pdf)

<sup>18</sup>Annual reports are published at: [dbh.nsd.uib.no/statistikk/dokumenter\\_htmlRapport.action?undermeny=statistikk\\_dokumenter&tabellId=621](http://dbh.nsd.uib.no/statistikk/dokumenter_htmlRapport.action?undermeny=statistikk_dokumenter&tabellId=621)

The HEIs' annual reports form a key component of the dialogue meetings between the institutions and the government. In these meetings, the institutions report on their strategic goals, as well as a set of sectoral goals outlined by the Ministry of Education and Research. Institutions are also expected to provide brief descriptions and self-assessments of policies and activities targeted, at among other things, cooperation and partnerships with society and industry which typically contribute to knowledge transfer. Notably, these activities are not part of the performance-based system.

### 4.3.1 Selected institutions

The five higher education institutions included in this mapping represent institutions with different research and educational profiles, sizes and funding structures, as well as different historical and regional contexts:

- The Norwegian University of Science and Technology (NTNU) is historically a technical university located in mid-Norway. Because of recent mergers with university colleges of applied sciences, the university now covers most disciplines and vocations, and it is spread over four different campuses.
- University of Tromsø - The Arctic University of Norway (UiT) is historically a comprehensive university located in Tromsø in Northern Norway. Because of recent mergers with university colleges of applied sciences in the region, the university now covers most disciplines and vocations, and it is spread across ten different campuses in the Northern region.
- University of Southeast Norway (USN) is the result of a merger between three regional university colleges, and they offer mainly vocational training. It obtained university status in Spring 2018.
- University of Stavanger (UiS) is a regional university in Stavanger which offers mainly vocational training. They gained status as a university in 2005.
- University of Agder (UiA) hosts a range of different study programmes, from mathematics and engineering to public administration, pedagogics, and social work. It was founded in 2007 when the former Agder University College was awarded status as a university.

**Table 4.1 Institutions surveyed**

	Staff members FTEs	Total no. of students	State Funding, mill NOK	RCN Allocations, mill NOK	EU Framework Programme Allocations, mil NOK
NTNU	7 135	40 180	6 595 498	1 018 183	161 511
UiT	3 487	16 475	3 059 497	234 445	23 828
USN	1 601	17 893	1 748 066	41 901	3 173
UiS	1 422	11 403	1 442 570	58 618	9 388
UiA	1 210	12 826	1 274 295	48 258	6 429

Source: DBH (2017) RCN = The Research Council of Norway. FTE = Full time equivalent.

All six institutions have decided on a long-term strategy which outlines their visions and goals, and selected priority areas. The strategies are the institutions' long-term steering document and form the framework for and level of ambition of institutions for years to come. Taking the strategies as a point of departure, all institutions display a commitment to innovation and knowledge transfer, and their role as key actors in regional development:

- *NTNU* carves out a special mission for their institution, which is to develop the technological foundation for the future society, by among other things contributing “to competitive business and industry as well as a capable public sector through collaboration in new practices, processes and products”.<sup>19</sup> They see innovation as a key trait of their academic environment, and innovation activities are singled out as a separate core task alongside teaching, research and dissemination. The pillars of their innovation strategy are a collaboration with established business and the public sector, and the creation of new businesses. This goal will be achieved by strengthening long-term collaboration with established business and the public sector to improve the innovation capability, increase the number of innovations, commercialisation projects and start-ups from staff and students and include training and innovation in the students' education
- *UiT, The Arctic University of Norway*,<sup>20</sup> stresses their special mandate and role in the region; in their strategy, they aim to “help promote economic, cultural and social development in the north through building knowledge and human capital”. Among other things, they will include innovation and

<sup>19</sup>[https://www.ntnu.edu/documents/139226/1278574844/20180228\\_NTNU\\_strategi\\_web\\_ENG.pdf/55963e61-038d-4f55-a7c8-c8e93c2c420b](https://www.ntnu.edu/documents/139226/1278574844/20180228_NTNU_strategi_web_ENG.pdf/55963e61-038d-4f55-a7c8-c8e93c2c420b)

<sup>20</sup>[https://en.uit.no/om/art?p\\_document\\_id=377752&dim=179033](https://en.uit.no/om/art?p_document_id=377752&dim=179033)



entrepreneurship in all study programmes and facilitate close contact between students and the business and industry community. Also, they stress the role of their TTO, and knowledge transfer to businesses and the industrial sector.

- *USN*<sup>21</sup> envision themselves as a regionally based entrepreneurial university with close collaborative partners in society and industry, and professional and industry-oriented research and education. They aim to be internationally competitive and actively involved in the region. They emphasise practice-relevant education in close collaboration with society and industry, as well as collaborative and practice-relevant research. Collaboration with society and industry in the region is outlined as a key condition for their entrepreneurial profile.
- *UiS*<sup>22</sup> highlight their innovative, international profile, and they stress that they “will be a driving force in knowledge development and the process of societal change”. Their objectives cover the core areas of education, research and dissemination/innovation, and the development of partnerships with end-users and private/public actors stand out in all three areas. They aim to promote innovation both in educational programmes and in research by providing opportunities for commercialisation, licensing and the creation of new companies.
- *UiA* highlight three areas in their strategy: Learning and education for the future; Global mindset; and Societal engagement and innovation. This strategy refers to inter alia to the university’s interaction with society, and they stress both knowledge development and strengthened efforts to commercialise research-based business ideas.

The sections below describe the knowledge transfer initiatives and activities which are developed to realise the institutions’ goals, in terms of collaborative arenas, coordination structures, and mobility schemes.

Institutional initiatives and instruments aimed at or contributing to knowledge transfer and interaction with industry and working life are found across different levels of the institutions, from the central level to more local initiatives that are organised in close relation to research activities or study programmes. While we find that all institutions have established and taken part in well-known infrastructure aimed at commercialisation such as TTO’s, incubators, and industry clusters, we find a greater variety in the structures established to coordinate commercialisation and knowledge transfer across different schemes and initiatives, as well as the initiatives launched to stimulate interaction between education/students and industry and working life.

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<sup>21</sup><https://www.usn.no/getfile.php/13505990/usn.no/en/Pictures/About%20USN/Strategies/USN%20strategy%202017%20-%202021.pdf>

<sup>22</sup>[http://www.uis.no/getfile.php/13419590/Ansattsider/Grafisk%20profil/EN\\_Strategi%20for%20UiS%202017-2020-1.pdf](http://www.uis.no/getfile.php/13419590/Ansattsider/Grafisk%20profil/EN_Strategi%20for%20UiS%202017-2020-1.pdf)

## 4.4 Collaborative arenas and activities

In the next sections, we first present institutions' coordination initiatives before we present examples of schemes for interaction and knowledge transfer related to R&DI and education respectively.

### 4.4.1 Comprehensive coordination structures

All institutions have established comprehensive structures on a central level to coordinate knowledge transfer and interaction with society. At NTNU, USN and UiA, these activities are described as central elements of the development agreements between the institutions and the Ministry of Education and Research launched in 2016. The purpose of the agreements is to enter into more binding aims for the institutions and to carve out more strategic and distinct profiles. Parts of the comprehensive structures at NTNU and USN are, thus, recently established following the agreement, and they operate as umbrellas for existing and new initiatives at the institutions.

#### *NTNU*

NTNU has several instruments for coordinating internal activities and external relations. In spring 2018, NTNU launched a strategic programme for knowledge-based innovation which is organised under the pro-rector for innovation. The costs of the initiative are shared between the faculties and the Rectorate. The programme is launched under the heading 'Innovation for a better world' and aims to increase "the conversion of NTNU's knowledge, ideas, technology, methods, and results from research into useful, specific innovations". Its main instrument is the employment of 15 innovation managers located at different faculties and professional communities at NTNU. Their primary task is to aid the commercialisation of research and develop a culture for innovation.<sup>23</sup> The programme also includes resources for developing the competence of the innovation managers.

NTNU also has other instruments which they emphasise as part of their stimulus package for innovation. These are:<sup>24</sup>

- New innovation grant scheme for PhD candidates
- Cooperation with NTNU TTO
- NTNU Discovery
- Further commitments to student innovation

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<sup>23</sup>For more detailed information see: <https://www.ntnu.edu/innovation-resources/knowledge-based-innovation>

<sup>24</sup>For more information see: <https://www.ntnu.edu/innovation-resources/knowledge-based-innovation>

The latter point emphasises entrepreneurship and several means – such as courses and study programmes, support offices, funds and networks – are available.

The stimulus-package can be characterised as “supply-driven”, as it emphasises development of research from the university to the society.

NTNU has several platforms for collaboration with public and private sector, which can be characterised as “user-driven”. They have bilateral collaboration agreements with, for instance, Equinor the largest oil and gas company in Norway, NAV - the Norwegian Labour and Welfare Administration and others. The agreements involve, amongst other things, the coordination of potential areas of research and education, and are normally financed by pre-seed funds from the collaborating partners and in-kind from NTNU - with the ambition of attracting third-party funding.

At the governing level, the University board and faculty boards have representatives from the public and private sector. The Council for cooperation with working life at NTNU is organised following a decentralised model, with three thematically organised councils, reflecting three core fields at NTNU; namely technology and business; health and health-related technology; and school, culture, and welfare. The councils assemble staff and external partners from relevant industry and public sectors and shall contribute to a comprehensive, strategic and systematic cooperation between NTNU and work and community life on education, research and artistic activities, development and innovation. They are expected to develop collaborative projects with time. Additionally, NTNU has several cooperation agreements regarding working life dedicated to ensuring relevance in study programmes.

Currently, NTNU is, in accordance with the development agreement, working on developing indicators with which can measure innovation from the university.

### *UiT*

In 2013, UiT established a Centre for career and working life as a central support and coordinating unit. The Centre aims to strengthen cooperation between education and working life, e.g. through internship agreements, industry involvement in bachelor’s and master’s theses, and continuing education. The centre moreover organises an annual seminar – the P.F. Hjort seminar, named after the first rector who was a strong proponent of the university’s responsibility for engaging with the community and promoting societal development. The seminar is an arena for discussion of how linkages between UiT and industry and working life can be strengthened and contribute further to value-creation in Northern Norway. The centre also operates as the secretariat of the Council for cooperation with working life (‘Råd for samarbeid med arbeidslivet’), and at the moment, UiT is in the process of launching a new council.

## *UiS*

UiS uses the council for cooperation with working life as a platform for interaction and strategic coordination with relevant external partners and schemes established for innovation and knowledge transfer. They have developed a decentralised structure with a central “Verdiskapingsforum” (Forum for value-creation). The Forum is headed by the Rector and includes representatives from parliament, local and county governing bodies, directors of relevant local and regional organisations, as well as more broad representation and specially selected individuals. A key event is an annual conference on relevant topics organised by the Forum.

Moreover, four associated thematic interaction groups are linked to the institution's strategic priorities and focus areas. They all represent different types of meeting points that the university has with its surroundings. These groups are a) a coordination group for innovation initiatives, aiming to gather the innovation initiatives and arenas in the region; b) a coordination group for large projects and cluster development that aims to ensure regional support for research and innovation projects, and to develop industrial clusters for innovation and concrete cluster applications; c) a coordination group for innovation and commercialisation, which aims to strengthen the links between student entrepreneurs and research-, industry- and entrepreneurial business development (including inter alia the local TTO); and d) a coordination group for Ullandhaug that serves as a meeting place for leaders of the institutions located together with the university. The activities of the group have resulted in several successful grant-applications to RCN together with external partners from the region.

## *USN*

In the development agreement with the Ministry of Education and Research signed in 2016, USN launched three priority areas that contribute to the coordination of activities aimed at the interaction and knowledge transfer. Each area is assigned a project leader who ensures the coordination and fulfilment of the goals in the development agreement. *USN Partnership* (Partnerskap) shall further develop and strengthen the interaction with industry to develop new work-oriented education programmes and research, development, and innovation activities. It coordinates four schemes: USN Industriakademi, R&DI experts, networks and interactions with working life, and industry-sponsored professorships (all more fully described later). *USN Profession* is established to strengthen the cooperation between research, education and the field of practice within health and social studies and teacher education. It coordinates several mobility schemes, including combined positions and exchange schemes (described more fully later). USN Digital aims to develop integrating digital structures to inter alia facilitate interaction

between staff and students at eight different campuses and to make it into one virtual campus and to develop ties to external partners.

At USN, they have established two councils linked to two out of the three priority areas of the institution. One is linked to USN Partnerships, and the other is linked to the USN Profession. Both councils bring together relevant actors and are expected to facilitate dialogue and interaction in the priority areas.

USN also has an offensive strategy to develop ties with different industry clusters. For instance, they are currently in the process of establishing an office at Herøya Industry Park to enhance their interaction with the industry. The industry park is located 6 km from the USN campus. This connection is initiated by the USN itself and is not incentivised by national instruments.

#### *UiA*

Following the development agreement with the Ministry of Education and Research, UiA has launched UiA Nyskaping. This effort is intended to foster creativity and innovation amongst students and staff, by providing professional support for transforming innovations into commercially viable projects. As the commercialisation unit at UiA, UiA Nyskaping manages the IPR on behalf of the university and works in close collaboration with the external commercialisation partner, Innoventus Sør, to commercialise research. UiA Nyskaping is tightly integrated into the regional business community, especially through collaboration with the regional chambers of commerce. An example of this collaboration is the mentor programme partnership which consists of over 50 mentors from the business community, mentoring student or staff projects.

UiA has extensive cooperation with several municipalities – ex. with Kristiansand Municipality on “University City Kristiansand”. The university is represented in regional development across numerous arenas, with the aim of strengthened interaction on education, research and innovation – herein entrepreneurship in particular.

#### **4.4.2 Institutional partnership initiatives and agreements**

As stated in the strategies of all five institutions, interaction and close contact with partners in industry and public sector is valued as vital parts of the institutions' activities. For all, this aspect is visible in the network of partnerships and collaboration agreements that the institutions have developed with external actors. While the content and the reach of these agreements vary, they are expected to condition interaction and knowledge transfer.

NTNU has entered into several collaboration agreements. One example is the partnership with Trondheim municipality, which has resulted in the project

Universitetskommune 3.0 (see Box 2). UiT has entered into collaboration agreements with several actors in the region, including Kunnskapsparken i Nord and Mo Industripark AS as well as several of the municipalities which host campuses. USN has developed collaboration agreements with both the municipalities and county municipalities that host USN's eight campuses. The agreements are expected to offer a frame for collaboration. UiS and UiA also emphasise collaboration and are formalising it with actors in the fields of practice related to vocational study programmes. UiS has a collaboration agreement with the Stavanger Chamber of Commerce aiming to facilitate knowledge transfer. Prioritised tasks include the communication of topics for bachelor and master theses (from industry to students and vice versa), giving students relevant work experience, making the private sector use the Industry PhD scheme, continuing education, collaboration on innovation projects as well as enabling mobility between the university and industry. UiA has extensive collaboration with several municipalities and is represented in regional development across numerous arenas (e.g. "Regionplan 2030"). Innovation and commercialisation are among the long-term goals of these collaborations.

### **Box 2. University municipality 3.0: NTNU and Trondheim municipality**

In January 2018, NTNU and Trondheim Municipality signed a 4-year bilateral collaboration agreement.\* The collaboration aims to provide access to relevant and up-to-date knowledge and skills needed in the municipal sector through committed long-term cooperation between the municipality and the university. It will establish arenas for research, innovation and education in areas of strategic importance for the sector. Moreover, it aims to establish a new model for continuous two-way knowledge and competence transfer between academia and the municipality.

Five thematic areas have been selected for the collaboration, all relating to key tasks and competence needs of the municipality: Education and child development, Health and welfare, Urban development, Innovation and transition, and Digitization and technology/Smart Municipality.

The collaboration project is mandated to (1) establish a joint committee for research, development, innovation and education (including continuing education, practice and research education) within all five thematic areas, (2) establish a governance structure that enables the coordination of decisions and priorities for the municipality and the university, (3) establish common schemes and guidelines for the exchange of personnel between the municipality and the university (shared positions, Public PhD fellowships, project positions, guest lecturers, etc.), and (4) define and follow up sub-projects within the five thematic areas.

\* <https://innsida.ntnu.no/wiki/-/wiki/Norsk/Universitetskommune>

## 4.5 Schemes for collaboration and knowledge transfer

In the following section, we present the schemes developed to condition the knowledge transfer of education, research and innovation, as found in the annual reports of the institutions. In addition to the schemes presented, all institutions host centres and research projects financed by the RCN and/or Horizon 2020 which include partners from industry and working life, and accordingly facilitate interactions and knowledge transfer. For example, USN is a partner in projects financed by the following national programmes: NCE, SFF, VRI, RFF, SFI and FME, in addition to several others. These projects and partnerships are not further described here because they are the outcome of national instruments and not institutional schemes, but they are recognised as a vital part of the institutions' interactions for knowledge transfer. Also, in order to make evident the different profiles of the institutions we have in table 4.2 included structures for interactions described above.

**Table 4.2 Schemes for collaboration and knowledge transfer\***

Host institution	Scheme	Aims	Organisation and activities
All	Business clusters	Increased competitiveness in the region	Cooperation and networking
All	FORREGION/Kapasitetsløft	Strengthen research capacity in areas of particular importance for business in these regions.	Funds from RCN FORREGION for recruitment of new researchers, study offers, postgraduate and further education programs, to enable industry to borrow researchers, student assignments or loans from business people to research.
All	Gift professorship	Strengthen specific research areas, enhance knowledge transfer	NTNU and USN have several professorships financed by counties and industry. UiS, UiT and UiA have some.
NTNU/UiT/UiS/UiA	TTO	The commercialisation of research and innovation	The TTO's are owned by the institutions in partnership with nearby organisations: NTNU TTO: NTNU, Helse Midt-Norge Norinova: UiT, Universitetssykehuset Nord-Norge and Norut. Valide: UiS, Nofima, Stavanger University Hospital, the International Research Institute of Stavanger (IRIS), Norwegian Institute of Bioeconomy Research (NIBIO), Norwegian University of Life Sciences (NMBU) and the Western Norway University of Applied Sciences (HVL). UiA Nyskaping and Innoventus Sør

NTNU/UiT/UIS/USN/UiA	Incubators	Provide support for businesses that try to establish new commercial activity, usually based on innovation.	NTNU Accel is owned by NTNU and SIVA, as well as several private actors. For staff and students Norinova is the incubator of UiT, co-owned with SIVA. Valide is the incubator of UIS, co-owned with SIVA and the student incubator Develop Vestfold innovation park: Proventia; Drive-incubator located at USN campuses Innoventus Sør: collaborates with UiA
NTNU	NTNU Discovery	The commercialisation of research; business establishments	Organised under the strategic programme for knowledge-based innovation. Offers early-phase funding of ideas and projects that have the potential to become commercially viable
	Innovationstipend	Increase the conversion of knowledge at NTNU into concrete innovations	Organised under the strategic programme for knowledge-based innovation. Give PhD candidates the time and opportunity to develop innovative ideas further in order to realise innovation.
	Universitets-kommune 3.0 (see Box 2)	Increased innovation and better interaction between NTNU and municipal units in Trondheim.	A comprehensive research, development and innovation cooperation agreement between NTNU and Trondheim municipality; including among other things schemes for the exchange of personnel, guest lectures, piloting of research.
	Bilateral collaboration agreements	Increase interaction on education, research and innovation	NTNU has several bilateral collaboration agreements with both public and private companies. Involves common funding of research projects, development of education.
	Study councils	Relevant education	Users are represented in councils where teaching content is discussed
	Technoport	Create good relations between academia and business.	In addition to the annual Technoport conference, the association organises many smaller events and meeting places for students, researchers, start-ups and established business.
	NTNU Bridge	A portal between NTNU students and working life, for collaboration on topics for assignments, internships and jobs.	Students and employers can register and search for/contact potential employers/employees. Teachers may also use NTNU bridge to get in touch with potential external collaborators
	PhD innovation programmes	Contribute to the commercialisation of research to enhance health services	School of health innovation IPR courses
	NTNU school of entrepreneurship	Educate the best business developers in the world	Two-year master degree programme
UiT	Innovation sabbatical	Stimulate staff to commercialise research results	The same premises as for research sabbatical. Staff may apply for a sabbatical for commercialising research
	Centre for career and working life	Coordinating role for interactions between students, staff and working life	Create networking arenas, coordinate existing relations, information. Arranges the yearly PF Hjort seminar – a meeting arena for working life, staff and students



	Internship	Create internship for students in firms/public sector	Firms may announce internship at the web page. For the students this may represent relevant work experience
	Design Thinking Lab	Hub for innovation and creativity	Master course for firms, Design thinking taught in three different courses
UiS	Centre for entrepreneurship	Stimulate increased innovation and interaction between education, research and business at UiS and in the region.	The centre host inter alia a master programme and courses for non-students in entrepreneurship.
	Plogen	Stimulate innovation activities.	Scheme for early phase funding of technology development projects, organised by Valide.
	Forum for value-creation	Strengthen the interaction between UiS and the region	Includes representatives from public and private regional actors. Organises an annual conference
	Thematic interaction groups	Increased cooperation with regional actors	Four groups: innovation initiatives, large projects and cluster development, innovation and commercialisation, network and meeting arenas
USN	USN Forny-project	Strengthen research-based innovation	USN does not have their own TTO but refers to operating similar functions on their own under the FORNY-project, as well as partnering with Innovation Kjeller and SILICA, a regional incubator.
	USN Partnership: Industriakademi	Strengthen interaction with industry	A master developed in collaboration with industry is characterised by that the students work 50 percent of their time in a relevant firm and write a thesis relevant for the firm. Contributes to knowledge transfer between the firm and the classroom
	USN Profession	Promote cooperation for knowledge transfer between municipalities and USN related to health and social studies and teacher education.	USN and the municipality will establish close, equal and binding cooperation to develop and strengthen professional education, increase R & D within the respective professions and professional educations, and collaborating more closely on student practices.
	Campus contacts	Increased and simplified interaction between the institution and the municipalities that host the institution	Centrally positioned staff from USN have designated contacts for the municipalities where the institution is located. They are expected to represent a door into the institution for both private and public actors and organisation in the municipality.
UiA	UiA Nyskaping	Increased commercialisation	Involves also 50 mentors from the business community which aid in promising student and staff projects
	University City Kristiansand	Strengthen cooperation on education, research and entrepreneurship	Includes a strategy and an action plan to strengthen the interaction between the university and the city.

*\*Potential mistakes or omissions are the responsibilities of the authors*

The above information shows that there are great differences between the HEIs in terms of the extent to which they have institutionalised the different channels of knowledge transfer. It also shows that they differ in terms of supply-driven knowledge transfer and user-driven knowledge transfer. As largest university with an emphasis on technology, we see that NTNU has both supply-driven and user-driven schemes and initiatives. The eco-system for supply-driven knowledge transfer (entrepreneurship and commercialisation) is well-developed, likewise at UiS. Bilateral agreements and the inclusion of firms and public agencies in councils and other cooperation mechanisms seem to be most prevalent at NTNU and USN. Compared to the others, UiT and UiA seem to have less institutionalised instruments and activities for enhancing collaboration regionally and nationally.

In general, the collaboration agreements – user-driven knowledge transfer - seem to target, first and foremost, education of students and, to some extent, research activities. This working paper illustrates that formalised collaborations at the institutional level emphasise students as the main channel of knowledge ‘transfer, while research collaboration is anchored both on the institutional and individual researcher or group level.

## **4.6 Mobility schemes**

As discussed in the previous section on mobility, this concept may refer to several different ways and activities that stimulate the exchange of staff and students and movement between sectors. Here, we focus on staff exchange exclusively, and we include a) schemes that are intended to facilitate intersectoral outbound mobility of academic staff, and b) schemes that are intended to facilitate inbound mobility, facilitating the mobility of people from the field of practice to academia.

In the following section, we present the mobility schemes used at the surveyed institutions, as presented in the annual reports.

**Table 4.3 Mobility schemes of the surveyed institutions**

<b>Institution</b>	<b>Name of scheme</b>	<b>Inbound or outbound</b>	<b>Description of scheme</b>
All	Public PhDs and industry PhDs	Inbound	This scheme is financed by the RCN, which facilitates knowledge exchange and competence building. RCN finances the doctoral education which is conducted while the candidate is employed in a company or a public organisation. Research is expected to have clear relevance to the company or the organisation.
NTNU	Working life contact in the humanities	Inbound	The faculty of Humanities has employed working life contacts in small part-time positions to facilitate closer contact and interaction between the academic environment and working life.
	Professor II	Inbound	Professors with main position in the public or private sector
	Combined positions	Inbound and outbound	The University municipality agreement aims at establishing combined positions between Trondheim municipality and NTNU. Aim to develop research competence in the municipality and relevance competence at NTNU. (see Box 2)
USN	Combined positions	Inbound and outbound	Positions developed in collaboration between the field of practice and the institution. The purpose of the inbound positions is to make the teaching more practical and relevant to the students, and for the outbound that employees in the institution contribute to research and professional development in the field of practice. The positions usually comprise 10-50% working years for two years. A professional from the field of practice can have such a combined position for a total of three periods, i.e. a maximum of 6. <sup>25</sup>
USN	Exchange scheme (“Hospitering-sordning”)	Outbound	Staff from USN may spend a period in the field of practice. The exchange may be the starting point for further cooperation on teaching and may also be the start of a research collaboration or development and operation of a joint R & D project. The scheme aims to facilitate knowledge exchange between the field of practice and the academic fields of health and social studies, as well as teacher training. The scheme is funded by the institution.
	USN Partnerskap: <ul style="list-style-type: none"> <li>R&amp;D&amp;I experts</li> </ul>	Inbound	USN has established a number of part-time positions (20%) which are reserved for people with their main positions in industry and business. Good industrial understanding and knowledge of their own business are key criteria rather than academic merits. They are expected to contribute to innovation and knowledge exchange between the institution and inter alia the business clusters in the region.
UiT	Industry-mentors	Inbound	Adjunct positions reserved for people from the industry who contribute with teaching and supervision in educational programmes. The positions are organised by the institution but financed by the VRI-programme under RCN.
UiS	Mobility grants	Outbound	The mobility grants are for international mobility (not mainly inter-sectoral) and intended for UiS postdocs and associate professors who want to carry out research abroad. Its funds stay at foreign research institutions or research active companies/public institutions “preferably located outside Norway”.

Apart from Professor II positions, mobility schemes are relatively new in the institutional context, and USN, which has developed this idea most extensively, is in an early implementation phase of the schemes. It is, therefore, too early to conclude their impact. Informants indicate, however, that the schemes have had the

<sup>25</sup> The exact details for the positions are not decided yet and are currently under hearing in the institution.

intended effects as they have realised increased collaboration regarding research and education with the partners through strengthening relations and giving insights into the partner's research problem areas. The industry mentor scheme at UiT has been active over several years, and so far, 48 people have been employed under this scheme. These people contribute first and foremost to the education and supervision of students. Also, the scheme for public and industry PhDs have been active over a few years. Both schemes are funded by the RCN.

The informants were divided in their views on whether there is a need for national initiatives to increase inter-sectorial mobility. Some underlined that this should be the responsibility of the individual HEIs, while others argued that inter-sectorial mobility is challenging, given the quest for academic merits which may represent a barrier for both outbound and inbound mobility. To increase mobility, they called for clearer policies from the Ministry of Education and Research

## 5 Concluding comments

Below we address the relationships - the policy mix - between the national and local instruments regarding the three knowledge transfer channels. In a recent report, OECD (2019) identify different kinds of positive and negative interactions that may arise when policy instruments are combined in a policy-mix. Positive interactions can be:

- an instrument may *precondition* the existence of another in order to be implemented.
- an instrument may *facilitate* the effectiveness of another instrument
- two instruments may have *synergies*, and enhance the effect of one another

Negative interactions can be:

- an instrument may *contradict* the other (e.g. open science/IPR)
- or too many instruments may result in too much *complexity*

### 5.1 Commercialisation of research

Our study finds that the two universities NTNU and UiS both have well-developed local systems and instruments for commercialisation of research which facilitates and creates synergies with the national instruments. One example is the access to local funding, which serves as a pre-proof of concept funding and is more easily available than the national "FORNY"-programme funding, as the former programmes have more frequent calls. Interestingly, UiT has recently introduced an innovation sabbatical – an instrument we do not find at the other universities.

It is relatively new, and there are no reports on the effect of this instrument on commercialisation and knowledge transfer. Prior studies of commercialisation of research indicate that it is challenging to get researchers to engage in commercialisation and that several tensions may arise for the individual researcher in the commercialisation process in relation to other obligations (e.g Link et al.2007; Borlaug and Jacob 2013). An innovation sabbatical may therefore enhance the probability for researchers to engage in commercialisation activities.

USN and to some extent UiA have, perhaps because of their more applied role, less focus on commercialisation of research through spin-offs and licenses, as most of the research completed there may be commercialised through collaboration with industry. However, UiA has relatively recently, on the basis of the development agreement with the Ministry, established a set of initiatives under the umbrella UiA Nyskaping aiming at entrepreneurship and start-ups among students and staff.

The variations in the types and extent of the initiatives supporting commercialisation seem to depend regional conditions as well as the type of HEI – i.e. size, profile and research intensity.

## 5.2 Collaborative research and education

Several instruments at the national level target research collaboration between the HEIs and private and public actors. The long-term and relatively well-funded schemes such as Centres for Research-based innovation, administrated by the RCN, seem to impact the HEIs in the way that they plan and coordinate the applications in advance of the calls, it is, thus, not solely dependent upon the initiatives of individual researchers. Some of the HEIs have several bilateral collaboration agreements with municipalities, counties, public agencies, and firms on research and education. The agreements often include the goal of attracting third party grants from, e.g. RCN. We have the impression that such agreements have become a more common means to ensure a two-way knowledge transfer through education and research. Nevertheless, research collaboration is still, first and foremost, the responsibility of the individual researchers and -groups. Collaboration on education, on the other hand, has received increased attention in national policy debates in recent years. The councils for working life (RSA) is probably the most visible national instrument in place to increase the dialog and collaboration between HEIs and working life within higher education. This instrument is however not a funding scheme and is therefore first and foremost a strategic means. We also observe that faculties, departments and even individual study programmes may establish their own councils and fora for collaboration with working life, although the range of such targeted councils varies between fields and HEIs. The councils seem to be more prominent at NTNU and USN.

Interactions through councils with representatives from different stakeholders appear to become more widespread. Furthermore, the increased emphasis on the relevance of education for working life in national policy, may release new national instruments targeted at collaboration on education in terms of mobility (students and staff), curriculum design and teaching.

### 5.3 Mobility

It is generally held that the mobility of researchers between academia and working life is rather modest in Norway. There are also few dedicated instruments in place to stimulate such mobility. As shown in chapter 3, it has recently been put forward a suggestion of introducing the position “practice professor” as a national scheme for strengthening mobility, but because professor is an academic title, the suggestion has been turned down. However, as Part II shows, the HEIs themselves have taken responsibility and established measures to ensure knowledge transfer through local mobility. For instance, the position “R&DI-expert” at USN is created to attract individuals with knowledge of industry’s research problems, but the experts do not need academic competence (i.e. PhD.). We observe, however, that the institutions have different practices and norms in this matter. NTNU, for instance, emphasises that such positions should, on principle require academic competence. While the institutions have autonomy to introduce different types of positions, the academic merit system seems to pose a barrier (contradict) to this type of knowledge transfer,

Based on the mapping, we may group the different mobility initiatives into three categories:

- Professor II positions
- Exchange schemes/mobility grants
- Mobility positions (experts, mentors)

The first is a common instrument in the system but requires academic merits. The second is, according to some of the informants, a less attractive instrument because it entails leaving the academic environment for a period, which for some staff may be seen as detrimental to the career since promotion mainly is based on academic merits. The last category seems to be under development, and the HEIs have the opportunity to introduce their own type of positions. Some informants claimed that one way to incentivise and strengthen this kind of institutional/local initiatives may be to include them in the development contracts that each HEI negotiate regularly with the Ministry of Education and Research.

Taken together, we may conclude that the policy mix for the three channels of knowledge transfer differs in terms of ministerial responsibility and governance

and the individual HEIs' emphasis on these given their profile. The Ministry of Education and Research owns the HEIs and steers education and research through performance-based funding, steering dialogues and development contracts. The commercialisation of research is the responsibility of the Ministry of Trade, Industry and Fisheries, and some of the HEIs have institutionalised local systems for technology transfer. The division of responsibility between the ministries may lead to a negative interaction of the policy mix, e.g. commercialisation is not incentivised by the owner. However, the system for technology transfer sees positive interactions between the national and institutional instruments.

There are also positive interactions between national and institutional policy instruments for collaborative research and education. National policies encourage collaborative councils and national intermediary agencies (RCN and Innovation Norway) fund collaboration on research and to some extent education. The institutions seek to strengthen this channel of knowledge transfer through bilateral collaboration agreements with industry/public agencies and local councils. It is also addressed in the steering dialogue and the development contracts of some of the HEIs. Inter-sectoral mobility is still the primarily the responsibility of the individual HEIs.

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