

# Adding value: From world-leading research to profitable commercialization

Findings from the site visits of seven universities and one research organization in Western Europe

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# Contents

Contents .....	2
Executive summary and major findings.....	4
Norwegian summary .....	7
1 Introduction.....	10
1.1 Universities in charge of IP.....	10
1.2 How successful is commercialization from Norwegian universities? .....	10
1.3 A perceived contradiction between scientific excellence and commercialization.....	12
2 Methods and scope of the report.....	13
2.1 World leading in both academia and commercialization .....	13
2.2 Methods .....	13
2.3 Universities that are excellent in both academia and innovation – based on rankings .....	13
2.4 Recommended places to visit .....	17
2.5 Semi-structured interviews.....	18
2.6 Reference group.....	18
3 Internal organization and culture of innovation and commercialization.....	20
3.1 Why commercialize?.....	20
3.2 Governance .....	22
3.3 Support systems for innovation and commercialization.....	23
3.4 Culture.....	23
4 Organization of Technology and knowledge transfer .....	24
4.1 Regulation of IP.....	24
4.2 Organization of the TTOs .....	24
4.3 University strategy and organization of knowledge transfer .....	26
5 Commercialization of research in Norway .....	28
5.1 Results of commercialization in the Norwegian system .....	28
5.2 Norway, the outlier.....	29
5.3 Challenges of the Norwegian system for commercialization .....	30
6 Policy recommendations.....	33
6.1 Initiate a university strategy processes for knowledge transfer.....	33
6.2 Dismantle the TTOs .....	33
6.3 Establish knowledge transfer units within the universities.....	34
6.4 Create a heterogeneous system for commercialization of research.....	34
6.5 Commercialization is just one part .....	34
Appendix 1 References.....	35
Appendix 2 List of abbreviations .....	37
Appendix 3 Interviews and meetings.....	38

A-3.1	Switzerland.....	38
A-3.2	Denmark.....	38
A-3.3	Belgium.....	38
A-3.4	Germany.....	39
A-3.5	Great Britain .....	39
A-3.6	Italy.....	39
A-3.7	Norway .....	39
Appendix 4	Notes from Interviews .....	40
A-4.1	Switzerland.....	40
A-4.2	Denmark.....	46
A-4.3	Belgium.....	48
A-4.4	Germany.....	50
A-4.5	Great Britain .....	52
A-4.6	Italy.....	54
A-4.7	Norway .....	57

# Executive summary and major findings

**Transferring knowledge to society is one of the key mandates of universities. Beginning in the 1980s, universities in Western countries have been given the responsibility for the ownership of the intellectual property (IP) produced by their scientists. Universities have developed different ways to organize the management of IP. The Norwegian system for knowledge transfer differs from that of other Western countries in that the responsibility for IP management and the commercialization of research has been outsourced to independent Technology Transfer Organizations (TTOs). We recommend that the Norwegian system for knowledge transfer should be redesigned.**

Research and innovation is regarded as an important basis for value creation in modern societies. Over recent decades, universities have been given increased responsibility for transforming high quality research into commercial products and services that contribute to the wealth creation of society.

The relationship between high-quality research and commercialization is the theme of this report. Simula has visited seven European universities and CERN (The European Organization for Nuclear Research) to further investigate how these organizations manage their IP and how they undertake the commercialization of research. All eight of these institutions are highly ranked for both scientific achievements and innovation.

Beginning in the 1980s in the United States, universities in almost all western countries were tasked with the responsibility of owning and managing the intellectual property (IP) generated in the universities. As the universities assumed this responsibility, they developed different ways of organizing this work. In general, universities have established some kind of *internal* unit that handles the ownership and management of IP. The position of this unit in the organization, as well as the form and size of the unit, varies among universities. This variation was also true for the organizations that we visited. Some of them were part of the central organization of the university, while others were organized as separate departments or other forms of units. In addition, most of the universities have some kind of *external* unit responsible for the activities to commercialize IP. The variation in the organization of these external units is also considerable. While some of the universities (e.g., the University of Copenhagen) have an internal Technology

Transfer Office (TTO) responsible for commercialization, others collaborate with fully independent organizations outside the university (e.g., the collaboration between Imperial College London and “Imperial Innovations”).

In Norway, the ownership and management of IP is conducted by autonomous TTOs. The Norwegian universities have no, or very small, units within the university to handle IP and commercialization. Rather, the employees of Norwegian universities are required to enter Disclosure of inventions (DOFIs) directly with the corresponding TTO, which then assumes all responsibility for commercializing the ideas.

In general, it is difficult to measure the success of the transfer of knowledge to society. Nonetheless, there are certain innovation-specific rankings of universities, and several investigations into the success of knowledge transfer that have been conducted. Although the University of Oslo places quite well on innovation rankings, the overall conclusion is that the ability of Norwegian universities to commercialize research is moderate to weak.

Norwegian universities do well, though not great, in international rankings of research. We do not find any strong or automatic relationship between academic performance and innovation. In fact, we observe that some universities with lower rankings than, for example, the University of Oslo may have higher rankings in terms of innovation, and vice versa.

The fields of research in which Norwegian universities excel are generally those fields with strong domestic industry (e.g., energy and maritime sector) and of international interest (e.g., ICT and life science). The scientific basis for commercialization of Norwegian research can, therefore, be considered sufficient, and



there are no obvious reasons that hinder Norwegian universities from successfully commercializing their research.

However, we find the following three aspects of commercialization in Norway to be especially problematic:

1. First, Norway lacks a strong culture for commercialization. The Norwegian discourse about commercialization of research is characterized by a concept of contradiction between excellence and relevance. If the value of commercialization is perceived to be lower than other activities within the university, it is inevitable that the results will be weaker.
2. Secondly, there is a lack of integration of commercialization in the core activities of the universities. There is ambiguity regarding the objectives of the commercialization work at all of the Norwegian TTOs, and there is weak internal strategy, culture and organization in the Norwegian universities to support and promote commercialization. The universities will then, inevitably, lack the competence in the organization to make the proper decisions about how to conduct commercial activities. Without such competence, it should be expected that the universities will underperform in commercialization.
3. Finally, our observations lead us to conclude that the “TTO model” for commercialization in Norway is not appropriate and has several inherent weaknesses. Most problematic, in our view, is that the model provides the universities an opportunity to avoid taking the proper responsibility for commercialization by “outsourcing” such activities. The exclusive rights of the Norwegian TTOs to receive DOFIs (Disclosure of inventions) from a university limits possible pathways to successful commercialization of ideas. The setup of the TTO model favors one particular mode of commercialization (licensing) and promotes low risk commercialization.

From our investigation, we recommend the following policy changes to the system for commercialization of research in Norway:

- **Strategy for knowledge transfer:** A strategy process for knowledge transfer from universities to society should be initiated. The Norwegian universities should develop specific and realistic strategies covering the whole field of knowledge transfer. Specifically, the university needs to position knowledge transfer in relation to their other core activities – research and education. The universities should specify their goals for knowledge transfer and then organize their governance model accordingly.
- **Dismantle the TTOs:** The universities, the Research Council of Norway and other public bodies should gradually reduce their support of the TTOs, eventually terminating their funding. Some of the TTOs could be transformed into organizations that specialize in the final phase of commercialization of research. However, after an initial transition period, these organizations should be self-sustaining.
- **Internal units for commercialization:** The universities should establish knowledge transfer units within the universities that can manage the ownership and development of IP. A portion of the, quite considerable, funding currently channeled into the TTOs could be diverted to the universities for the purpose of establishing internal units. A reform, as suggested here, should not require additional funding, any increase in the total number of people working with commercialization for the universities, nor an increase in the bureaucracy associated with commercialization - quite the contrary.
- **Heterogeneous system for commercialization:** A more heterogeneous system for commercialization of research needs to be created. A future system for the commercialization of research should avoid exclusivity for a certain type of

organization. The universities should look for a variety of partners and approaches for transferring their knowledge and technology to society. If we are truly looking for innovative solutions and new applications, we should also look for new ways of translating knowledge for society's use.

Even though this report argues strongly for the importance of commercialization and recommends some drastic measures, we strongly recommend that the two other core activities – research and education – must continue to be the highest priorities. Commercialization is one aspect of the “third mission”, along with innovation, entrepreneurship and outreach. By balancing the different missions of the universities, we believe that both the universities and society will benefit.

# Norwegian summary

**Formidling av kunnskap til samfunnet er en av hovedoppgavene til universitetene. Utover 1980-tallet overtok universiteter i vestlige land ansvaret for eierskapet til immaterielle rettigheter (Intellectual Property – IP) produsert av forskerne. Universitetene har utviklet forskjellige måter å organisere forvaltningen av sin IP. Det norske kunnskapsoverføringssystemet skiller seg fra andre vestlige land ved at ansvaret for IP-forvaltning og kommersialisering av forskningen har blitt «outsourcet» til uavhengige Teknologioverføringskontorer (Technology Transfer Organisations – TTOs). Vi anbefaler en kraftig omorganisering av det norske kunnskapsoverføringssystemet.**

Forskning og innovasjon blir sett på som et viktig grunnlag for verdiskaping i moderne samfunn. I løpet av de siste tiårene har universitetene blitt tillagt et økende ansvar for å omdanne forskning av høy kvalitet til kommersielle produkter og tjenester. Ønsket er at det skal bidra til økonomisk vekst og velferdsutvikling.

Forholdet mellom de to; forskning av høy kvalitet og kommersialisering av denne forskningen, er temaet i denne rapporten. Simula har besøkt syv europeiske universiteter, samt CERN (The European Organization for Nuclear Research). Målet har vært å undersøke nærmere hvordan disse organisasjonene forvalter sin IP og hvordan de driver kommersialisering av forskning. Alle åtte organisasjoner er høyt rangert i vitenskapelige prestasjoner og innovasjon.

Med utgangspunkt i USA på 1980-tallet, fikk etterhvert universitetene i nesten alle vestlige land ansvaret for å eie og forvalte immaterielle rettigheter (IP) generert ved universitetene. Universitetene utviklet forskjellige måter å organisere dette arbeidet på. Generelt har de etablert en form for *intern* enhet som håndterer eierskap og forvalter IP. Posisjonen til denne enheten i organisasjonen, så vel som enhetens form og størrelse, varierer mellom universitetene. Dette gjaldt også for organisasjonene vi besøkte. Der noen interne enheter var en del av den sentrale organisasjonen av universitetet, var andre organisert som separate avdelinger. Det var også tilfeller av andre former for mer frittstående enheter.

I tillegg har de fleste universitetene en form for *ekstern* enhet som er ansvarlig for aktiviteter for å kommersialisere IP. Variasjonen i organiseringen av disse eksterne enhetene er også betydelig.

Mens noen av universitetene (f.eks. Københavns Universitet) har en intern TTO som er ansvarlig for kommersialisering, samarbeider andre med mer eller mindre uavhengige organisasjoner utenfor universitetet (f.eks. samarbeidet mellom Imperial College London og "Imperial Innovations").

I Norge har eierskapet og forvaltningen av IP blitt overlatt til uavhengige TTO-er. De norske universitetene har ingen, eller veldig små, enheter innenfor universitetet for å håndtere IP og kommersialisering. Snarere er de ansatte ved norske universiteter pålagt å melde inn sine ideer (Disclosure of Inventions – DOFI) direkte til TTO-en universitetet samarbeider med. Deretter påtar TTO-en seg alt ansvar for kommersialisering av ideene.

Det er vanskelig å måle i hvilken grad universitetenes kunnskap overføres til samfunnet. Ikke desto mindre er det noen innovasjonsspesifikke rangeringer av universiteter, samt flere undersøkelser av kunnskapsoverføring som har blitt utført. Selv om Universitetet i Oslo plasserer seg ganske bra på innovasjonsrangeringer, er de overordnede konklusjonene at norske universiteters evne til å kommersialisere forskning er moderat til svak.

Norske universiteter klarer seg bra, men utmerker seg ikke, i internasjonale rangeringer av forskning. Vi finner ikke et sterkt eller automatisk forhold mellom akademiske prestasjoner og innovasjon. Faktisk observerer vi at endel universiteter som har lavere vitenskapelig rang enn for eksempel Universitetet i Oslo, kan ha høyere rangering når det gjelder innovasjon, og omvendt.

Forskningsfeltene som norske universiteter utmerker seg innen er generelt områder med sterk innenlandsk industri (f.eks. energi og

maritim sektor) eller av internasjonal interesse (f.eks. IKT og biovitenskap). Det vitenskapelige grunnlaget for kommersialisering av norsk forskning kan derfor anses som tilstrekkelig, og det er ingen åpenbare grunner som hindrer norske universiteter i å kommersialisere forskningen sin.

Imidlertid synes vi følgende tre aspekter knyttet til kommersialisering i Norge er spesielt problematiske:

1. For det første mangler Norge en sterk kultur for kommersialisering. Den norske diskursen om kommersialisering av forskning er preget av et motsetningsforhold mellom kvalitet og relevans. Hvis prestisjen knyttet til kommersialisering oppleves som lavere enn andre aktiviteter innen universitetet, er det uunngåelig at resultatene blir svakere.
2. For det andre er det mangel på integrering av kommersialisering i universitetets kjernevirksomhet. Det er uklart når det gjelder målene for kommersialiseringsarbeidet ved alle de norske TTO-ene. I tillegg er det en svak intern strategi, kultur og organisering i de norske universitetene for å støtte og fremme kommersialisering. Universitetene vil da uunngåelig mangle kompetanse i organisasjonen til å ta riktige beslutninger om hvordan de skal drive kommersiell virksomhet. Uten slik kompetanse er det å forvente at universitetene vil underprestere innen kommersialisering.
3. Våre observasjoner leder oss til å konkludere med at «TTO-modellen» for kommersialisering i Norge ikke er tilfredsstillende og har flere iboende svakheter. Etter vårt syn er det mest problematiske ved modellen at den gir universitetene en mulighet til å unngå å ta ansvar for kommersialisering ved å «outsourse» slike aktiviteter. De norske TTO-enes eksklusive rett til å motta DOFI-er fra forskerne, begrenser alternative strategier for vellykket kommersialisering av ideer. Oppsettet av TTO-modellen favoriserer en bestemt metode for kommersialisering (nemlig lisensiering) og fremmer kommersialisering med lav risiko.

Gitt våre observasjoner, har vi følgende anbefalinger for endringer i systemet for kommersialisering av forskning i Norge:

- a. **Strategi for kunnskapsoverføring.** En strategiprosess for kunnskapsoverføring fra universiteter til samfunnet bør igangsettes. De norske universitetene bør utvikle spesifikke og realistiske strategier som dekker hele kunnskapsoverføringsfeltet. Spesifikt må universitetene plassere kunnskapsoverføring i forhold til deres andre kjerneaktiviteter: forskning og utdanning. Universitetene bør fastsette klare mål for sin kunnskapsoverføring og organisere styringsmodellen deretter..
- b. **Avslutte TTO-ordningen.** Universitetene, Norges forskningsråd og andre offentlige organer bør redusere sin støtte til TTO-ene over tid og til slutt avslutte finansieringen. Noen av TTO-ene kan omdannes til organisasjoner som spesialisere seg i slutfasen av kommersialisering av forskning. Etter en overgangsperiode, bør imidlertid disse organisasjonene være selvfinansierende.
- c. **Interne enheter for kommersialisering.** Universitetene bør etablere kunnskapsoverføringsenheter innenfor universitetene som kan eie og forvalte IP. En del av den betydelige finansieringen som i dag kanaliseres til TTO-ene, kan omfordes til universitetene for å etablere slike interne enheter for kommersialisering av forskning. En reform som foreslått her burde ikke kreve ekstra finansiering, økning i det totale antallet som jobber med kommersialisering for universitetene, eller en økning i byråkratiet knyttet til kommersialisering - snarere tvert imot.
- d. **Heterogent system for kommersialisering.** Et mer heterogent system for kommersialisering av forskning bør utvikles. Et fremtidig system for kommersialisering av forskning bør unngå eksklusivitet for en viss type organisasjon eller visse metoder for kommersialisering. Universitetene bør bruke ulike partnere og tilnærminger for å overføre sin kunnskap og teknologi til samfunnet. Hvis vi virkelig ser etter innovative løsninger og nye applikasjoner, bør vi også se etter nye måter å oversette kunnskap til bruk for samfunnet.

Selv om denne rapporten argumenterer sterkt for viktigheten av kommersialisering og anbefaler noen drastiske tiltak, mener vi sterkt at de to andre kjerneaktivitetene - forskning og utdanning - må fortsette å være høyest prioritert.



Kommersialisering er ett aspekt av det «tredje oppdraget», sammen med innovasjon, entreprenørskap og formidling. Å balansere universitetets forskjellige oppdrag, vil tjene både universitetene og samfunnet som helhet.

Forfatteren vil takke alle som har bidratt, spesielt alle dem involvert i besøkene i utlandet. Alle feil står for forfatterens regning.

# 1 Introduction

Science is seen as an instrument to increase a nation's global competitiveness (Bush, 1945; McMillan, Narin, & Deeds, 2000; OECD, 2014). Key technologies in modern societies have their origins in research conducted in universities (Mazzucato, 2015); several of the largest companies in the world, including Facebook and Google, were started in universities. National innovation policies seek to improve domestic advantages in “a world in search of an effective growth strategy” (page 21 in Soete, Schneegans, Eröcal, Angathevar, & Rasiah, 2015; UNESCO, 2015).

Countries can apply a wide range of measures to improve their global competitiveness<sup>1</sup>. First, governments have implemented measures to strengthen research, education, and innovation at universities, such as the German *Universities Excellence Initiative*<sup>2</sup>. A second set of measures is substantiated by societal needs and global challenges. Public policy derived from such reasoning is more mission oriented and project based.

Universities (often referred to as Higher Education Institutions – HEIs) have a key role in translating science into competitive products and services. In this report, we investigate the connection between excellent research and the ability to commercialize. We do not ask which university is the best, but rather try to identify any similarities between the universities that perform well *both* academically and in terms of commercialization.

## 1.1 Universities in charge of IP

Norwegian Higher Education Institutions (HEIs) have been responsible for their IP for the last 20 years. Following the lead from the US, most universities of Western Europe gained responsibility for their IP at about the same time

(see chapter 4). By law (Act relating to universities and university colleges<sup>3</sup>), Norwegian universities are obliged to contribute “to innovation and value creation on the basis of the results of research and academic and artistic development work.”

In the early 2000's the Norwegian universities, in collaboration with the authorities, created a comprehensive system of Technology Transfer Offices (TTOs). These TTOs have the mandate to carry out the commercialization activities on behalf of the universities (Spilling, Borlaug, Iversen, Rasmussen, & Solberg, 2015). The TTOs are owned by a mixture of universities and other owners (see Figure 5-1 in Grünfeld, Teie, Hvide, Spilling, & Borlaug, 2018) and the owners provide support for the activities in the TTOs. In addition, the Research Council of Norway provides substantial financial support for the TTOs<sup>4</sup>.

## 1.2 How successful is commercialization from Norwegian universities?

There are few well-established methods to assess the ability of universities to develop their research from academic excellence to profitable products and services. In this investigation, we used existing established rankings to assess the universities' academic and commercial abilities. We used the Innovation index established by Reuters to assess innovative ability and the “Shanghai ranking” (Academic Ranking of World Universities; “ARWU”<sup>5</sup>) to establish academic performance (see chapter 2 for methods). By calculating the universities' average rank according to these indices, we identified which universities that we should examine closer.

<sup>1</sup> For a more comprehensive review, see the report “Missed opportunities: National research labs in Norway” at [https://www.simula.no/sites/default/files/governmental\\_research\\_labs\\_report\\_kyl\\_151208\\_0.pdf](https://www.simula.no/sites/default/files/governmental_research_labs_report_kyl_151208_0.pdf)

<sup>2</sup> [https://en.wikipedia.org/wiki/German\\_Universities\\_Excellence\\_Initiative](https://en.wikipedia.org/wiki/German_Universities_Excellence_Initiative)

<sup>3</sup> <https://www.regjeringen.no/en/dokumenter/act-relating-to-universities-and-univers/id213307/> (The Norwegian text:

<https://lovdata.no/dokument/NL/lov/2005-04-01-15>)

<sup>4</sup> In the years 2011-2015, about €70 million has been spent on TTOs (mainly) and some other commercialization activities.

<sup>5</sup> <http://www.shanghairanking.com/index.html>

Figure 1 shows the top 50 ranked universities in the world based on the calculated average of the Shanghai ranking (horizontal) and The World's Most Innovative Universities <sup>6</sup> (vertical axis, the highest ranked universities to the top).

We observe that the 50 universities that are ranked high for both academic performance and innovation are dominated by American universities. Only seven of the top 50 performers are European (marked in red), five are Asian (only one is visible in Figure 1 as the four others have an ARWU score too low to be

displayed as the vertical axis is truncated) and one is Canadian. From just the innovation index (the horizontal axis of Figure 1), one Danish university (Technical University of Denmark) is ranked as number 43. They are, however, not very strong academically, thus they are not visible on the combined graph of Figure 1. No Norwegian university can be found among the top 50 performers, ranked either for innovation or in combination with academic performance. Measured this way, and on the global scale, the Norwegian universities are not strong performers in converting science to profit.

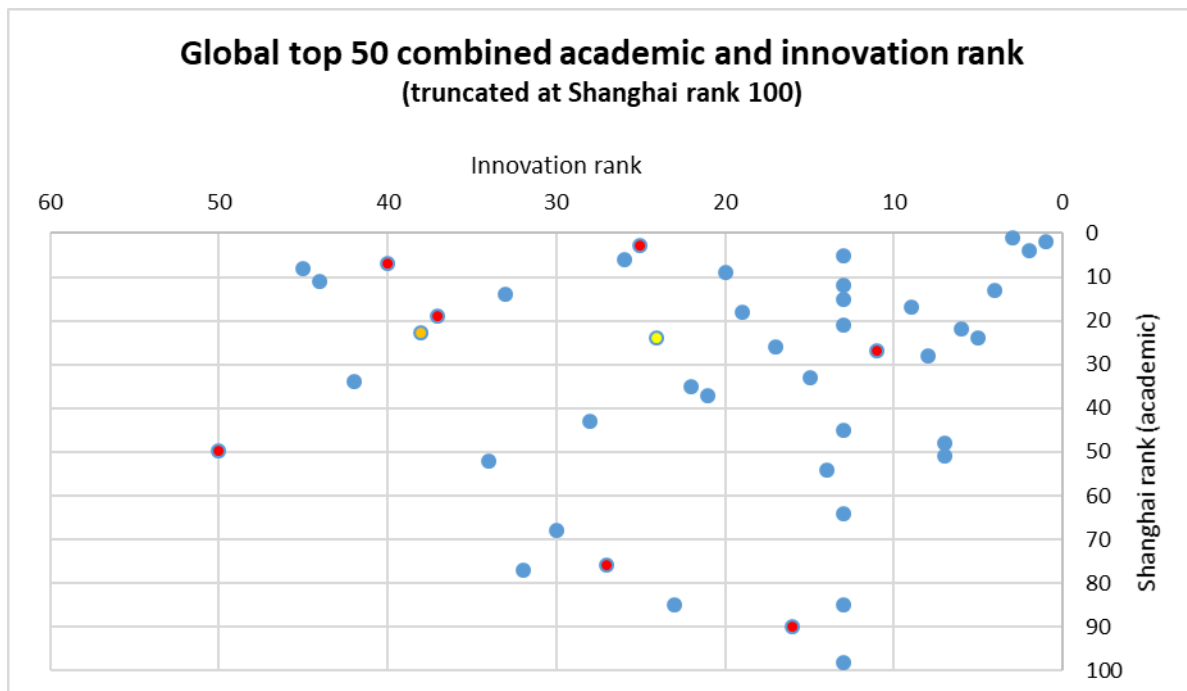


Figure 1. The 50 highest ranked universities in the world based on the average of the Shanghai ranking (horizontal) and The World's Most Innovative Universities ranking (vertical) from 2015. See Table 1 in chapter 2 for a list of the top 20 universities. All the American universities are marked in blue. The European universities are marked in red, one Asian university in yellow and one Canadian university in orange (see chapter 2 for methodology).

The Norwegian government has conducted a more detailed comparison between TTOs in Norway and in a few other Western countries (the "Research Barometer"; Kunnskapsdepartementet, 2015)<sup>7</sup>. Looking into measures such as disclosures of inventions (DOFIs), patents, establishment of new companies (Figure 2), licenses and more, they conclude that the results of Norwegian TTOs

are moderate or weak compared to other countries (Kunnskapsdepartementet, 2015).

<sup>6</sup> <http://www.reuters.com/article/idUSL1N11K16Q20150915>

<sup>7</sup> <https://www.regjeringen.no/no/dokumenter/forskningsbarometeret-2015/id2409822/>

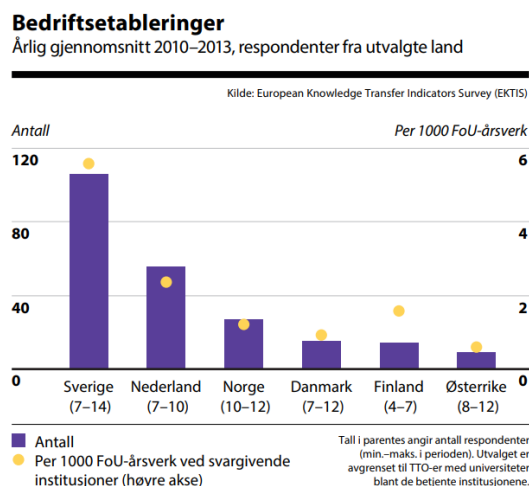


Figure 2. The number of companies established (“Bedriftsetableringer”) by TTOs in selected countries, annual average over 2011–2013. From left: Sweden, The Netherlands, Norway, Denmark, Finland and Austria. Copied from the “Research barometer” (From Kunnskapsdepartementet, 2015).

Finally, we have compared the performance of the Norwegian university TTOs with the performance of Simula’s organizations for commercialization (the incubator Simula Garage and the investment fund *Simula Innovation*). Even though the organization of Simula differs from that of the universities, it was demonstrated (Arge, 2016)<sup>8</sup> that the university TTOs are underperforming in terms of ownership, effectiveness and establishment of new businesses<sup>9</sup> (see Figure 6 below).

A recent evaluation of commercialization of research in Norway (Grünfeld et al., 2018) concluded that “the scope and profitability of the activity remains low, relative to the explicit ambitions that have been expressed through the policy for innovation and knowledge in recent years.”<sup>10</sup> Furthermore, the evaluation report estimates that only 40 percent of the commercialization activities are actually conducted by the TTOs, while other activities are conducted outside the control of the universities. An early evaluation of the

Norwegian support system for innovation (Borlaug et al., 2009) further concluded that the “TTOs have so far not succeeded in bringing up a sufficient number of projects with a great potential for commercialisation.” We conclude that there is considerable room for improvement in commercialization of research at Norwegian universities.

### 1.3 A perceived contradiction between scientific excellence and commercialization

Although the obligation to commercialize research is written into law, the Norwegian debate about commercialization of research is characterized by a concept of some contradiction between excellence and relevance<sup>11</sup>. This way of arguing has been noticed outside of Norway. The OECD has produced a review of the Norwegian innovation system (OECD, 2017)<sup>12</sup>, commissioned by the Ministry of Education and Research as part of the revision of the Long-term plan for research and higher education<sup>13</sup>. In their report, the OECD explicitly states that there does not need to be any contradiction between quality and relevance: “*High scientific productivity can go hand in hand with impressive results in technology transfer*”. They, furthermore, provide several examples in their report about universities that perform well in both research and technology transfer (OECD, 2017, page 76 and 77)<sup>14</sup>.

In the chapters that follow, we look more closely into how the commercialization of research is organized internally at the universities and externally at the interface with the rest of society. We also discuss the culture for commercialization at various universities. Finally, we will review the Norwegian system for the commercialization of university science in comparison to the other universities that we have reviewed.

<sup>8</sup> Simula will update this analysis with 2019-numbers during fall 2019/spring 2020.

<sup>9</sup> <https://www.simula.no/publications/performance-metrics-technology-transfer-offices>

<sup>10</sup> Our translation. Original text: “Omfanget av og lønnsomheten i aktiviteten er fortsatt lav, sett opp mot de ambisjoner man har gitt uttrykk for gjennom nærings- og kunnskapspolitikken de senere år.”, page 2.

<sup>11</sup> E.g., the Norwegian “Productivity commission” (<http://produktivitetskommisjonen.no/>).

<sup>12</sup> <https://www.regjeringen.no/no/dokumenter/oecd-reviews-of-innovation-policy-norway-2017/id2556520/>

<sup>13</sup> <https://www.regjeringen.no/no/tema/forskning/innsiktsartikler/langtidsplan-for-forskning-og-hoyere-utdanning2/id2615974/>

<sup>14</sup> <https://www.regjeringen.no/contentassets/f371e66d57db43bea685b45ab1c40313/presentasjoner-konferanse-2017-06-13.pdf>, slide 65: “Example KU Leuven: Excellence and relevance can go hand in hand”, “An example of many in Europe”

## 2 Methods and scope of the report

In this report, we explore the role of universities<sup>15</sup> in innovation and commercialization of science by way of case studies and desk top studies. More specifically, we have examined the link between world-leading research and commercialization of science. We have investigated what characteristics are typical of the universities that are world leading in both academia and in innovation. In particular, we are interested in how the link between research and commercialization is organized in these successful institutions.

### 2.1 World leading in both academia and commercialization

It is notoriously difficult to measure the relationship between research and innovation. Measuring the innovative capabilities of a university has proven very hard, not least as the idea of the entrepreneurial university is quite a recent one (Pinheiro & Stensaker, 2014). Choices of timeframe, indices (e.g., patents, ideas, proof of concept, licenses, work creation etc.) and geographic scope have profound effects on the results (see below, section 2.3 and e.g., Figure 3). Still, a consistent pattern seems to emerge: those universities that are highly ranked on academic performance (e.g., the “Shanghai ranking”; see section 2.3) also do well when innovation is measured<sup>16</sup>. This is in line with findings in the literature both at the organizational level (Di Gregorio & Shane, 2003) and the individual level (Perkmann et al., 2013).

### 2.2 Methods

The main question in this investigation is:

*What are the best practices for universities that combine excellent research with successful commercialization?*

In our investigation, we have gathered the experience of universities and other research organizations in selected western countries (see below for selection criteria). The methods follow the work from the main author’s previous report on national research laboratories<sup>17</sup> in 2016.

### 2.3 Universities that are excellent in both academia and innovation – based on rankings

To identify universities that are excellent in both science and innovation/commercialization, we have used the available rankings for academic performance and for innovation. There are several well-established rankings for academic performance, but few for innovation and commercialization. We have used three different rankings:

1. To assess performance in innovation and commercialization we have used **The Reuters Top 100 World’s Most Innovative Universities**<sup>18</sup> for 2015 (Global Innovative Universities, “GIU”): This ranking is based on Patent Volume, Patent success, Global patents, Patents citations, Patent citation impact, Patent to Article citation impact, Industry article citation impact, Percent of Industry Collaborative Articles and Total Web of Science Core Collection Papers<sup>19</sup>. All innovation indices are highly variable from year to year (see below). There are few established rankings for innovation and commercialization, but GIU has gained considerable traction over the past few years, and universities are

<sup>15</sup> We have also included CERN; see below. In the rest of the report, the “universities” involved in this investigation will include CERN unless otherwise stated.

<sup>16</sup>

<http://www.reuters.com/article/idUSL1N11K16Q201509>

<sup>15</sup>. We observe, however, that some of the Asian universities high on the innovation rankings have low scores on the academic rankings.

<sup>17</sup> <https://www.simula.no/news/report-%E2%80%9Cmissed-opportunities-national-research-labs-norway%E2%80%9D>

<sup>18</sup>

<http://www.reuters.com/article/idUSL1N11K16Q201509>

<sup>19</sup> For methodology, see: <http://www.reuters.com/most-innovative-universities/methodology>



using the (positive) results of the index in their marketing and self-promotion<sup>20</sup>.

However, it must be noted that the GIU only includes certain aspects of innovation. E.g., a university's ability to create new companies is not part of the index; neither is income and revenue obtained from spinouts. Furthermore, it should be noted that this particular indicator favors certain types of scientific disciplines above others. The whole concept of patents is well aligned with the methods within medicine and life science. However, within fields such as Information and Communication Technology, spinouts and start-ups are much more common methods to commercialize science. Traditionally, commercialization has been much more common within the "hard sciences". We may thus expect a bias towards universities with strong engineering and technology profiles.

2. To identify the most innovative European universities, we used **The Reuters Europe's Most Innovative Universities**<sup>21</sup> for 2017 ("EIU"). This ranking is based on the same methodology from Reuters as the global innovation ranking. Since this investigation started, Reuters has published updated rankings for 2018 and 2019. The top 30 universities for this period were identified by averaging their rankings over this period (2017-2019), and the range of their rankings is displayed in Figure 3. We observe that for some of the universities (e.g., University of Copenhagen, Kings College London, Ruprecht Karl University

Heidelberg and Sorbonne University) the range is quite large. However, the highest ranked universities are more stable than the rest<sup>22</sup>.

3. To assess the academic performance of the universities, we used **The Shanghai Ranking**<sup>23</sup> (Academic Ranking of World Universities; "ARWU") for 2017. ARWU is possibly the most well-known of the academic rankings of universities. Another alternative could have been the Times Higher Education ranking<sup>24</sup>. We conducted some preliminary comparisons between the two rankings. Since our goal was not to rank institutions, but to identify a group of institutions, we concluded that the two rankings were sufficiently similar for our purpose. We chose ARWU for convenience.

We acknowledge that all academic rankings have considerable weaknesses (F. N. Piro & Sivertsen, 2016). Piro and colleagues (F. Piro et al., 2014) demonstrated how "differences [in results] may be attributed to both small variations on what we believe are not important indicators, as well as substantial variations on what we believe are important indicators." However, as ARWU has been accepted for several years, we believe that most of its weaknesses are known, and that all leading universities are included. Whether or not the exact ranking is correct is not of importance to us in this investigation.

<sup>20</sup> See e.g., <https://sciencebusiness.net/network-news/ku-leuven-europes-most-innovative-university-fourth-year-row> and <https://www.dtu.dk/english/news/2016/10/dtu-still-the-most-innovative-university-in-the-nordics?id=80f6288c-2612-4f91-bac3-c3d97272aed2>

<sup>21</sup> <http://www.reuters.com/article/us-reutersrankings-europeanuniversities-idUSKBN17Z09T>

<sup>22</sup> "The single unifier: Nearly all of them emphasize practical research and applied science, as opposed to pure academics. Technical universities and colleges dominate Reuters' first-ever ranking of Europe's top 100 innovative

universities, a list that identifies the educational institutions that are doing the most to advance science, invent new technologies, and help drive the global economy."

<https://www.reuters.com/article/us-innovative-stories-europe-idUSKCN0Z00CT>

<sup>23</sup> <http://www.shanghairanking.com/index.html>

<sup>24</sup> The "Shanghai ranking" (Academic Ranking of World Universities (ARWU); <http://www.shanghairanking.com/index.html> and Times Higher Education World University Rankings; <https://www.timeshighereducation.com/>

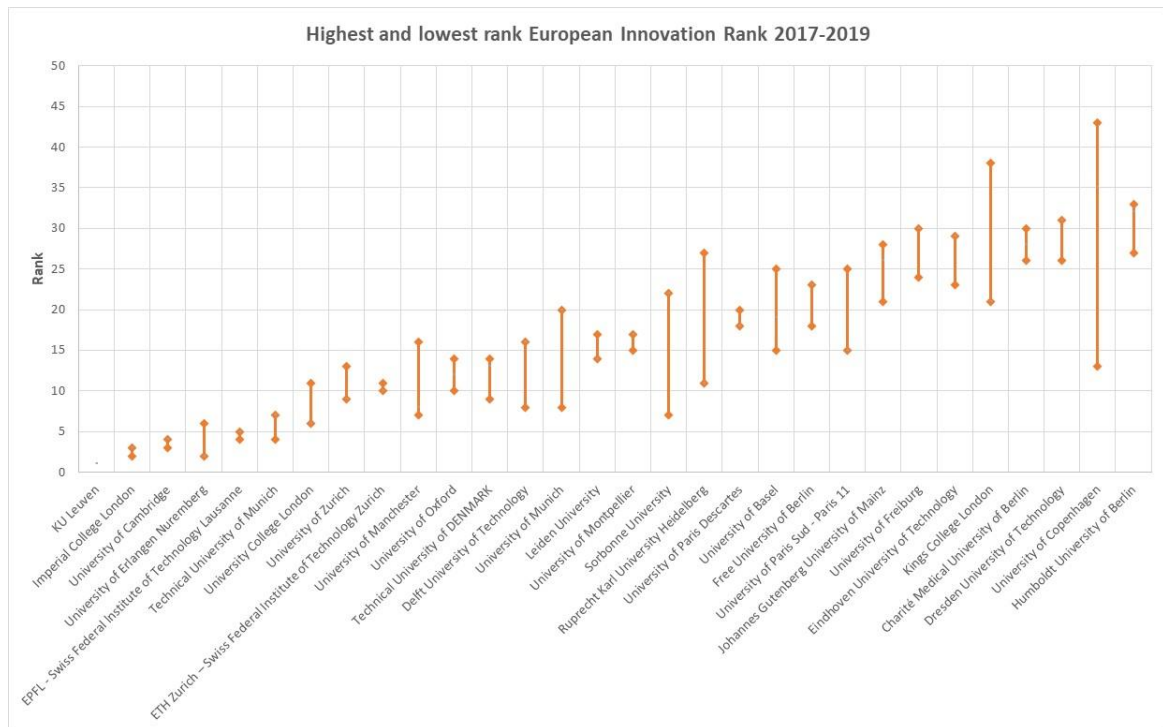


Figure 3. Difference between the highest and lowest rank of the top ranked universities in Europe for innovation (the order of the universities is according to the average over the 2017, 2018 and 2019 rank of Europe's Most Innovative Universities produced by Reuters; see text).

Based on these three indices, two lists were compiled:

1. **Global top 20 list:** A list of the world's 50 highest ranked innovative universities (GIU) was compiled (all of the University of California system institutions were tied in 13<sup>th</sup> place as they have a common system for innovation). The mean between the GIU-rank and the ARWU-rank was then calculated and the top 20 universities based on their average rank is provided in Table 1.

As can be observed, only two European universities make it into the top 20 list

(University of Cambridge and Imperial College London) along with one Japanese university (University of Tokyo). Only eight European universities can be found in the top 50.

2. **European top 20 list:** Based on the European ranking (EIU), the highest ranked innovative universities in Europe were compiled. The mean between the EIU-rank and their respective ARWU-rank was then calculated. The top 20 universities from this procedure are given in Table 2

Table 1. Top 20 universities in the world combining innovation ranking (The “GIU”; see text) and academic ranking (ARWU for 2015).

Rank	Name	GIU rank	ARWU rank
1	Stanford University	1	2
2	Harvard University	3	1
3	Massachusetts Institute of Technology (MIT)	2	4
4	University of Washington	4	13
5	University of California, Berkeley	13	5
6	University of Pennsylvania	9	17
7	University of California, Los Angeles	13	12
8	Northwestern University	6	22
9	University of California, San Diego	13	15
10	University of Cambridge	25	3
11	University of Michigan System	5	24
12	California Institute of Technology	20	9
13	Princeton University	26	6
14	University of California, San Francisco	13	21
15	University of Wisconsin System	8	28
16	Imperial College London	11	27
17	Johns Hopkins University	19	18
18	Duke University	17	26
19	University of North Carolina Chapel Hill	15	33
20	University of Tokyo	24	24

Table 2. Top 20 universities in Europe, combining innovation ranking for 2017 (“EIU”; see text) and academic ranking for 2017 (ARWU). The universities marked with an asterix (\*) are also present on the world top 50 list (see Table 1).

Rank	Name	EIU rank	ARWU rank
1	University of Cambridge*	3	3
2	University of Oxford*	10	7
3	Imperial College London*	2	27
4	Swiss Federal Institute of Technology Zurich (ETH)*	11	19
5	University of Copenhagen	13	30
6	Pierre & Marie Curie University - Paris 6	7	40
7	Technical University of Munich*	4	50
8	University of Manchester	16	38
9	University of Paris Sud - Paris XI (Paris-Sud University)	22	41
10	University of Edinburgh	34	32
11	University of Zurich	9	58
12	University of Munich (LMU Munich)	12	57
13	Heidelberg University	27	42
14	EPFL (Swiss Federal Institute of Technology Lausanne)*	5	76
15	Ghent University	19	69
16	KU Leuven*	1	90
17	Utrecht University	50	47
18	Leiden University	17	88
19	Erasmus University Rotterdam	32	73
20	University of Oslo	46	62

Seven of the eight European universities that made it to the global top 50 list also made it to the European top 20 list (marked with asterix in Table 2). Technical University of Denmark did not (in place 31). Intuitively, we would expect the eight universities that made it on the global top 50 list to take the top eight positions in the European ranking. However, while the Shanghai-ranking is the same, the innovation index is not. Firstly, it is from 2017 instead of from 2015, which in itself may cause some changes. Furthermore, the Innovation index is based on relative strength for several of the sub-indices. Thus, as the statistical population changes (especially when the US universities are removed), the different sub-indices change as well.

We also note that for the European universities, the impact of academic rank changes the order profoundly. The most innovative university in Europe, KU Leuven, does not have a very high Shanghai rank. Several of the most innovative universities (e.g., University of Erlangen-Nuremberg, Delft University of Technology and Technical University of Denmark) are not ranked in the top 100 on the Shanghai ranking, consequently not making it on this top 20 list. As with the global ranking (Figure 1), we visualize the combination of academic rank and innovation rank in Figure 4 by plotting the two ranks against each other. The relationship between academic performance and innovative performance is moderate ( $R^2=0.16$ ).

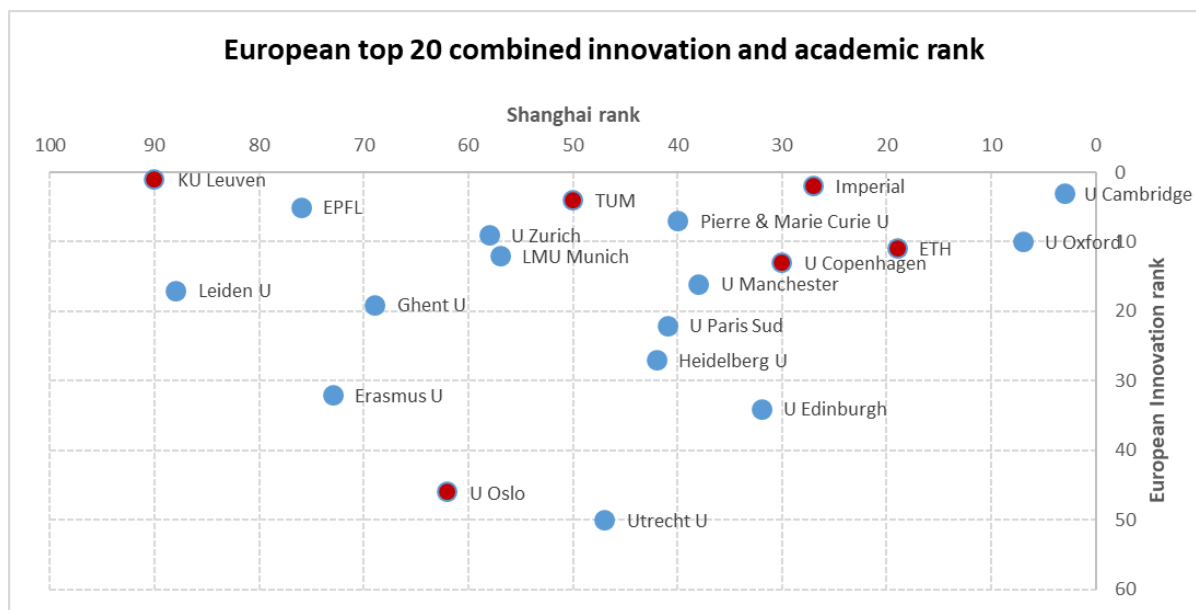


Figure 4. The 20 highest ranked universities in Europe based on the average of the Shanghai ranking (horizontal) and Europe's Most Innovative Universities ranking (vertical) from 2017. The universities marked in red were visited in this investigation. In addition, we visited Polytechnic University of Milan (Shanghai rank of 250 and European Innovation rank of 39) and CERN, which is not included in these rankings.

## 2.4 Recommended places to visit

Due to practical considerations, only European sites were visited for this investigation. To assemble a list of potential places to visit, the following criteria were used.

- The best European universities, combining academic and innovative rankings found in Table 2/Figure 4.
- Selected collaborators of Simula (e.g., TU Berlin, Polytechnic Milan) or of others in the reference group (see below).
- Other non-university institutions that are excellent in both academia and innovation.

These criteria resulted in the following list:

**Potential European institutions to visit:**

First priority institutions marked with \*.

- England: University of Cambridge\*, University of Oxford\*, Imperial College London\*
- Switzerland: ETH\*, CERN\*, University of Zurich, EPFL (Swiss Federal Institute of Technology Lausanne)
- Belgium: KU Leuven\*, Ghent University
- Germany: Technical University of Munich\*, Technical University Berlin\*, University of Munich (LMU Munich), Heidelberg University
- France: Pierre & Marie Curie Université - Paris 6, University of Paris Sud - Paris XI (Paris-Sud Université)
- Denmark: University of Copenhagen, Technical University of Denmark
- The Netherlands: Delft University of Technology, Utrecht University, Leiden University, Erasmus University Rotterdam

**Actual European institutions visited:**

The following institutions were visited:

1. England: Imperial College London
2. Switzerland: ETH
3. Switzerland: CERN
4. Belgium: KU Leuven
5. Germany: Technical University of Munich
6. Denmark: The University of Copenhagen.
7. Norway: The University of Oslo
8. Italy: Politecnico di Milano

The positions of six of these institutions are marked in Figure 4, as they all are on the top 20 list for combined academic and innovation rank among universities. The remaining two visited institutions are not shown in Figure 4, as Politecnico di Milano is outside the top 20 and CERN is not a university.

## **2.5 Semi-structured interviews**

We utilized our own network, as well as networks of members of the reference group (see below) to approach the institutions we wanted to visit. We identified people to meet who had a thorough knowledge of the

innovation work at their respective university, and in-depth knowledge of the management of the institution. As can be seen in the appendices, there was a wide variety in the position of the people we met. At some universities, we met with numerous people holding various offices, while at other institutions we met only one or two people. In general, the people we met were very knowledgeable about the overall work of their institutions.

The contact persons at each institution were provided with a three-page description of our investigation prior to the meetings. We conducted semi-structural interviews (Edwards & Holland, 2013) with the people we met. A list of topics was prepared before the investigation started and some of the questions were refined, from our experiences, along the way.

Following each site visit, notes from the interviews and follow up questions were provided to the contact person at the respective institution. With one exception, all of the contacts responded and assisted with supplemental information, which may have been lacking, and/or corrected any mistakes. They were all informed that we only asked for their assistance in checking facts, and that all interpretations were our responsibility. The notes are provided in Appendices 3 and 4. These notes constitute the core of the exposés in the rest of the report.

## **2.6 Reference group**

A reference group was set up to advise, assist and collaborate in this investigation, consisting of the following people:

- Kyrre Lekve, Deputy Managing Director, Simula Research Laboratory, leader
- Christian H. Bjerke, Director of Innovation at Simula Research Laboratory
- Erlend Arge, Administrative Manager at Simula Research Laboratory and author of the 2016 report about Norwegian commercialization of research<sup>9</sup>.
- Carl Martin Rosenberg, PhD-student at Simula Research Laboratory
- Mats Lundqvist, board member of Simula Research Laboratory, Professor,



Technology Management and Economics, Chalmers University of Technology

- Bjørn Stensaker, Professor – Department of Education, University of Oslo (UiO) and Research Professor, The Nordic Institute for Studies in Innovation, Research and Education (NIFU)
- Magnus Gulbrandsen, Professor – TIK Centre for Technology, Innovation and Culture, UiO
- Taran Mari Thune, Professor – TIK Centre for Technology, Innovation and Culture, UiO
- Per Koch, Editor and Special advisor The Nordic Institute for Studies in Innovation, Research and Education (NIFU)
- Kristin Oxley, Senior Adviser at the Research Council of Norway, Chief

Executive's staff, previously manager of FORFI<sup>25</sup>.

- Espen Solberg, Head of Research at NIFU, previously the Norwegian Ministry of Education and Research, as well as OECD.
- Kristin Vinje, Vice dean, The Faculty of Mathematics and Natural Sciences at UiO, former Member of Parliament<sup>26</sup>.

The group was consulted on the three-page description of the investigation, which was to be provided to the interviewees and they were offered the opportunity to take part in the site visits. Kyrre Lekve (author of this report) took part in all the site visits.

The reference group has also received the draft of this report, and several members have contributed valuable comments. Nonetheless, they are not personally responsible for the final conclusions in this report.

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<sup>25</sup> A program in The Research Council of Norway 2009-2014, developing the knowledge basis for research and innovation policy.

<sup>26</sup> Recently (1 September 2019) appointed dean of School of Health Sciences at Kristiania University College.

### 3 Internal organization and culture of innovation and commercialization

In this chapter, we summarize how the universities and CERN organize their innovation and commercialization activities *internally*. In section 3.1, we discuss the reasoning and thinking behind innovation and commercialization; in this context, CERN provides an interesting contrast. In section 3.2, we explore how innovation and commercialization is governed. In section 3.3, we look into the variable approaches for providing managerial support for innovation and commercialization. We conclude the chapter with a closer look at the cultures for innovation and commercialization (section 3.4).

The University of Oslo was the only institution we visited that did not have any *internal* unit for innovation and commercialization. All other organizations have some kind of unit, reporting to top management, which is responsible for bringing IP from ideas to potential investments.

#### 3.1 Why commercialize?

Traditionally, education and research have been the core activities of universities. In a societal perspective, the main commercial output of universities was, and still is, by way of students leaving the universities and contributing in commercial companies. Historically, commercial applications arising from the research were managed somewhat randomly. Most commonly, the professors could freely utilize his/her research for commercial purposes. Around the turn of the millennia, the universities in most countries were given the rights to all IP developed by their employees (see section 4.1 below and e.g., section 6.2.2. in Grünfeld et al., 2018 for more details). This right was also associated with an obligation to manage the IP rights (IPR) of the university. In addition to education and research, some kind of outreach, innovation and commercialization activities are now expected to take place at the universities (Grimaldi, Kenney, Siegel, & Wright, 2011). As shown in section 1.1, in some countries these expectations have been written into the bylaws

of universities or into the law regulating universities.

The strongest organizational idea for universities, especially the publicly funded ones, has traditionally been that of *the research university* (Pinheiro & Stensaker, 2014). These loosely-coupled organizations with collegial governance and a lot of authority, delegating from the top to the bottom of the organization (Clark, 1983) has been the dominating idea in post-WWII Europe and the US. As higher education and research have been globalized and the universities have faced new expectations (e.g., management of IP), both the universities themselves and their organizational ideas have been challenged. In addition, some countries (e.g., the US) have also seen a decline in industrial research laboratories, and the traditional research universities are now tasked with new roles in technology transfer of their discoveries (Sanberg et al., 2014).

As a consequence, the notion of the research university has been challenged by new concepts, such as the *entrepreneurial university* (see Pinheiro & Stensaker, 2014, for a thorough discussion of these trends). Maassen and Stensaker (2019) has observed that this development is associated with a tighter vertical integration within the universities, but not necessarily a tighter horizontal integration. Thus, we can observe strong leadership and professional organizations, but not necessarily an organization able to cope with a multitude of demands and expectations that can sometimes be contradictory.

The manifestations of these developments are easily observed in the institutions we visited. Innovation is now clearly emphasized in many of the institutions' mission statements. For example, "One of Europe's most innovative universities" (University of Oslo), "The Entrepreneurial University" (Politecnico di Milano), and "All programmes at this University are based on the innovative research of its scientists and professors" (KU Leuven). As expected, the universities and institutions we visited were at different stages of integrating

innovation into their core activities, and of adapting their organization accordingly

Of the organizations that we have visited, **CERN** (The European Organization for Nuclear Research) appeared to be the most deliberate on their approach to commercialization of research. CERN is owned, funded and managed by 23 member states, and their activities are strongly regulated by the CERN convention (see more in Appendix A-4.1.2). Due to these special circumstances, the CERN administration has been required to carefully consider how to conduct their innovative activities and commercialization. As a consequence, their approach to innovation and commercialization is well founded. Furthermore, for CERN knowledge transfer is a prioritized deliverable to society, while earning money from their research and technology does not hold the same priority. “Someone will make money out of our research, but not necessarily us”, explained one informer. Different from the other universities, CERN uses the term “knowledge transfer” instead of the more common “technology transfer” with regard to their office/organization for innovation. Some similar aspects were emphasized by The **University of Copenhagen**. They stated that technology transfer was a priority – not to earn money.

At the other end of the spectrum, organizations like **ETH Zurich**, Technical University of Munich (**TUM**) and Politecnico di Milano (**Polimi**), all seem to conduct activities within innovation and commercialization with a certain naturalness – working with innovation and commercialization appears to be internalized by the organization and the scientists. These organizations have formulated performance indicators for their innovation and commercialization work (note: ETH does not set commercial goals, while TUM and Polimi do). **Imperial College** and **KU Leuven** also have formulated performance indicators; however, at these organizations it was emphasized that research was the first priority.

The reason to conduct innovation and commercialization activities seemed to be less clearly formulated at the University of Oslo (**UiO**). At UiO, no performance indicators are given for their innovation and commercialization work.

The formulation of goals for commercialization is closely related to the culture of the institutions. We will return to this topic in the final section of the chapter.

There is no obvious, single, correct way to realize the transfer of knowledge and technology to society. From a government’s perspective, it is not of significance who receives the income from the knowledge developed in the universities as long as it contributes to the growth and prosperity of society. Thus, models can be imagined with either strong commercialization within the universities or a policy for transferring new knowledge into the business sector, away from the University, swiftly and effectively. The problem of the first model (of strong commercialization) is that public funding may interfere with innovation and commercialization in a private market. This may lead to suboptimal solutions and expensive pathways to innovation. The challenge of the second model is – as emphasized by several informants – that an idea is not the same as a business model. In most cases, the inventors are needed to develop the idea through several steps before it can be transformed into a business model, with a product or a service ready for a market. Thus, a model where the university simply releases their ideas to the open market, risks that the ideas are not developed to their full potential.

While the particular details of the actual model chosen for commercialization may not be very important (there are considerable differences in the details for the models of the universities involved in this investigation), the conscious choice of one or another type of model will have consequences for the organization and management of their innovation activities. We observe that when a university lacks a clear idea of why and how they want to conduct their commercialization activities, the organizational unit responsible for conducting the commercialization activities is weakened and often must work outside the core organization of the university (Schoen, de la Potterie, & Henkel, 2014). We will return to this phenomenon in the next section.

### 3.2 Governance

Broadly speaking, we can distinguish between the *internal* organization and the *external* organization of innovation and commercialization.

The “internal organization” is what exists within the university management structure; is there a specialized and separate unit or department? Is this unit/department centrally organized or are the activities distributed among the basic units of the university? Who leads the innovation and commercialization activities, and whom do they report to?

The “external organization” is the interaction between the university and the business sector outside. We will review this aspect in the next chapter.

#### Internal unit for

**innovation/commercialization.** When considering governance of innovation and commercialization, we find the most striking observation of this investigation: is that the University of Oslo (UiO) is the only university, which we visited, that does not have an internal unit for innovation and/or commercialization. All of the other universities that we visited have a well-defined internal unit for innovation and/or commercialization within their core organization. Although the exact organization and/or position of the unit varies, technology transfer is part of their core governance structure, and innovation and commercialization are integrated in the university activities. Heads of the units report to top management (e.g., rector, deputy president, director general, etc.).

On all of the homepages of the universities’ websites, it is fairly easy to find the pages pertaining to innovation and commercialization:

- Imperial College London: Top item “Research and Innovation”
- Polimi: Top item “Third Mission”
- KU Leuven: After choosing “Research” choices like “Science to business” is readily available.
- ETH: Top item: “Industry & Society”

- TUM: top item: “TUM & Business”
- University of Copenhagen (UCPH): Top item: “Collaboration”
- CERN: Under top item: “About”, “Our contribution to society” is available.
- UiO: Under top item: “About UiO”, “Innovation at UiO” is available.

From these pages, the relevant unit is easily located for most organizations. For UCPH, one needs to maneuver quite a bit. For UiO, there is no unit specialized in innovation and/or commercialization. The Department of Research Administration<sup>27</sup> seems to have some of the relevant responsibilities, such as “Innovation and entrepreneurship in research and among students”; however, no one has been assigned the corresponding responsibilities in the department.

**Top management support.** Most of our informants emphasized that support from top management is instrumental in creating innovative universities. The development of substantial innovation/commercialization activities is fairly recent in all of the organizations that we have visited. In the process of building activities and an organization, the support from top management has been important to legitimize the activities. In addition, our informants highlight the changes in the universities themselves as important. If the top management embraces innovation, entrepreneurship and commercialization, it is much easier to build a support system and working units.

For most of the universities we have visited, our informants experience an enduring positive attitude to innovation, entrepreneurship and commercialization. A few of our informants described some setbacks along the way and expressed uncertainty regarding the permanence of such positive attitudes.

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<sup>27</sup>

<https://www.uio.no/english/about/organisation/los/fadm/index.html>

### 3.3 Support systems for innovation and commercialization

The support systems that exist at the different universities vary widely (Grimaldi et al., 2011). All units have some kind of routines and systems for promoting innovation and for scouting ideas (e.g., through innovation competitions). Several of the organizations also invite external entrepreneurs into their activities to a certain degree.

With the exception of **UiO**, an *internal* unit for innovation/commercialization handles the process from the initial disclosure of an idea, through some kind of selection and seed phase, until the idea is ready for business development. Personnel at the internal unit for innovation/commercialization takes care of IP at this stage. In the next phase, the idea (with or without the innovator), is gradually transferred to a unit specialized in accelerating new ideas. This organization is sometimes owned by the university itself, while at other times it may be fully or partly owned by external actors. In general, the accelerator unit operates independently regardless of precise ownership.

When the idea has matured and is ready for investments etc., the most common next step is that an external TTO takes care of the actual commercialization of the IP. As can be seen in the appendices, the models for kick-back to the universities also varies quite a lot.

UCPH is somewhat different from most of the other universities. Their innovations are predominantly in the life science field. UCPH has, as a consequence, developed a model centered on licensing agreements with a few selected, large biomedical companies in Copenhagen. At UCPH there is a direct change-over from the (internal<sup>28</sup>) TTO to the companies conducting the commercialization.

At UiO, the entire process of commercialization is overseen by the external TTO (Inven2), from the initial declaration of the idea through to potential external investments. The ideas (DOFIs) can thus be submitted directly to Inven2 without the explicit involvement of UiO administration.<sup>29</sup>

### 3.4 Culture

As referred to in the introduction, the Norwegian debate about the commercialization of research has been characterized by a concept of a contradiction between excellence and relevance (OECD, 2017). There have been negative attitudes towards entrepreneurship, innovation and (especially) commercialization of research. Traces of these sentiments could also be found in several of the institutions we visited.

At **CERN**, the model of knowledge transfer is adapted to the mission of the Organization. Although not necessarily negative to knowledge transfer, the priority of the scientists, and of the Organization, is fundamental physics.

At **UCPH**, they recognized the existence of negative attitudes towards commercialization. However, as UCPH merged with two research institutes in 2007, the traditional academic culture was confronted with a much more applied culture. The leadership of UCPH invested strongly in combining the strong academic quality of (the original) UCPH with the applied attitude of the other two institutions. The process constituted a big cultural change from the old internal, university-oriented mindset to a more externally-oriented thinking and attitude. This was reinforced by the funding structure in Denmark where there is strong private funding of basic research. The ten largest private companies spend more of their profit on basic research than what is funded by the public sector.

All the institutions emphasized the importance of excellent, fundamental research. Apart from UiO, CERN and UCPH, (and somewhat at Polimi), the others did not currently experience any resistance from the researchers. More often than not, they experienced the opposite: support, collaboration and interest from the scientists. It is interesting to note that **ETH**, when recruiting, actively search for talent that operates in both research and commercialization.

<sup>28</sup> The TTO of UCPH is organized internally in the university. The other TTOs we have encountered (whether they use the term or not, are external.

<sup>29</sup> <https://www.inven2.com/no/innovasjon/meld-ny-ide>



## 4 Organization of Technology and knowledge transfer

In this chapter, we summarize how systems for Knowledge/Technology transfer are organized. While chapter 3 was about the internal organization of commercialization, this chapter is devoted to the *external* organization (the interaction between the university and the business sector). We have applied a theoretical model to develop a typology of the external units of the universities included in this investigation.

### 4.1 Regulation of IP

Over the last 30 to 40 years, we have seen profound changes in universities around the world. The rise of the “knowledge-based economy” (including the rise of new technologies such as biotechnology and ICT) and the “massification” of higher education, as well as the increasing reliance on universities as policy instruments to drive local development processes, are some of the forces changing the university landscape (Geuna & Muscio, 2009). These forces have led to many changes in the university system, including an institutionalization of knowledge transfer activities. The Bayh–Dole Act<sup>30</sup>, permitting a university to pursue ownership of an invention, was introduced in the US in 1980. Gradually, similar changes were introduced in Europe, starting in the Netherlands and Scandinavia. The Act relating to universities and university colleges<sup>31</sup> in Norway was changed in 2003. From then on, the universities were obliged to contribute “to innovation and value creation on the basis of the results of research and academic and artistic development work.” As with Germany and Denmark, Norway removed professorial rights (Geuna & Muscio, 2009). In effect, the responsibility for the management of

IPR was transferred from individuals to the universities.

### 4.2 Organization of the TTOs

The *external* organization of knowledge transfer is probably where the variation between the universities is largest: some do not have any organization or partner for the actual transfer of IP from the university to the market (e.g., UCPH), while others have separate Technology Transfer Offices (TTOs). Some of these TTOs are controlled completely by the university, while others are more or less independent from the university. Some of the TTOs work exclusively with one university and some universities work exclusively with one TTO. Some TTOs collaborate with a complex environment of external operators, with the Technical University of Munich (TUM) as a prominent example. The UnternehmerTUM (U-TUM) associated with TUM, consists of four separate companies, of which one of them is non-profit. U-TUM is formally independent, but is “attached to TUM” (this is similar to the technology transfer office Imperial Innovations (II), of the Imperial College of London).

Spilling and colleagues (2015) have published a comprehensive evaluation of the organization and function of the Norwegian system for commercialization of research. Much of the coming sections are based on their descriptions<sup>32</sup>.

Commercialization of research is of course not new. However, the 1980s and 1990s saw an *institutionalization* of the commercialization activities (Geuna & Muscio, 2009). Different organizations charged with assisting commercialization of research were established at the Norwegian universities during this time period. However, after the law was changed in 2003, all the universities established Technology

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[https://en.wikipedia.org/wiki/Bayh%E2%80%93Dole\\_Act](https://en.wikipedia.org/wiki/Bayh%E2%80%93Dole_Act)

<sup>31</sup> <https://www.regjeringen.no/en/dokumenter/act-relating-to-universities-and-univers/id213307/> (The

Norwegian text:

<https://lovdata.no/dokument/NL/lov/2005-04-01-15>)

<sup>32</sup> The original report (Spilling et al., 2015) is published in Norwegian. Any instances of lost in translation is the responsibility of the author(s).

Transfer Offices (TTOs) within a few years. Some of the organizations established in the 1980s and 1990s were transferred to a TTO, while at two of the universities (Bergen and Tromsø) internal TTOs were established. Today there are 10 universities and 10 TTOs in Norway<sup>33</sup>. Eight of the TTOs collaborate with one university each (and often with other research organizations as well), one TTO collaborates with two universities (and many research institutes), while the final TTO exclusively serves the largest research institute in Norway, SINTEF. The universities and research organizations using the services of the TTOs pay annual fees ranging from €0.2 million to €1 million (Spilling et al., 2015)<sup>34</sup>. Most of the other funding of TTOs come from the Research Council of Norway (see footnote 4).

Following the typology developed by Schoen and colleagues (Schoen et al., 2014), the Norwegian TTOs are *autonomous* TTOs. While the classical TTOs are integrated into the administrative structure of a university, the Norwegian TTOs typically have their own board (although most often led by someone from top management at the university), that make their own budget allocations and manage their own human resources.

Schoen et al. (2014), furthermore, defines three key functions of a TTO, describing a TTO as an intermediary between the university and industry:

1. Research funding and activities.
2. IP management (including identifying, selecting and out-licensing of inventions).
3. Spin-out services.

TTOs conducting all three functions can be described as fully integrated. As far as we know, the Norwegian TTOs are not involved in research funding and activities (thus being “forward integrated” in the typology of Schoen et al., 2014).

If we try to map the eight case-studies in this report, we notice first that seven of the institutions, except UiO, have some sort of internal unit taking care of one or more of the three key functions of a TTO. As far as we can see, none of the eight institutions has tasked any

autonomous TTO with research funding and activities. Indirectly, income from commercialization of research can be funneled back into research (licensing for sponsored research, for equity or for cash; Markman, Phan, Balkin, & Gianiodis, 2005), thus constituting research funding. For most of our eight case-studies, the surplus income from the commercialization is low (with possible exceptions for KU Leuven and UCPH). It is very common that TTOs do not generate a large surplus (Siegel, Waldman, & Link, 2003). The normal model seems to be that the goal of the university is that the innovation, entrepreneurship and commercialization activities should be self-sustained by the income from commercialization.

IPR management is handled internally at all of the institutions in our investigation, except for UiO. Furthermore, in all seven of these institutions, the choice of method of commercialization is made by the internal technology/knowledge transfer office (most often in dialogue with an external partner; see below). As an example, whether or not to take out patents is much discussed at most of the places we visited. For example, for ICT inventions it is well known that the time to market is more important than patent protection. Thus, a spinout company may be a more effective way of commercialization than a license following a patent protection process. Furthermore, at CERN they have reduced the number of patent applications and running patents dramatically, partly because the Knowledge Transfer Office of CERN has experienced that the unique expertise of CERN is often sufficient to protect their inventions, and partly because the Organization favors non-exclusive licenses wherever possible.

Three of the eight universities (TUM, Imperial College London and Polimi) combine an internal office for knowledge transfer with a powerful external TTO (U-TUM, II and Polihub respectively; see Appendix 4). As with the other institutions, the internal offices of TUM, Imperial College London and Polimi manage/secure the IPR of the universities. The third key function of a TTO is, in these instances, tasked to the external partner (while

<sup>33</sup> <https://www.forskningsradet.no/en/apply-for-funding/funding-from-the-research-council/Support-commercialisation-research-results/>

<sup>34</sup> Today, the University of Oslo pay NOK 11 million to Inven2 (about €1.1 million).

the university is still an active partner and collaborator in most activities).

For the final four institutions (ETH, CERN, UCPH and KU Leuven), their TTOs are also conducting the spin-out services. This is the normal model internationally (Brescia, Colombo, & Landoni, 2016).

The eight case studies can thus be differentiated along two dimensions: Firstly, the TTO of UiO (as well as the other TTOs in Norway) is autonomous and independent, not integrated into the administrative structure of the university. Of the seven other institutions four have an internal TTO-like organization that deal with commercialization, while the final three combine an internal organization with an external TTO/commercialization partner. Secondly, the eight case-studies can be differentiated according to the key functions they are tasked to do. None of our case-studies assign research funding and activities (item 1) to the TTO. UiO is the only institution leaving IP management to the TTO (item 2). TUM, Imperial College London and Polimi leave the spinout services to an external partner (item 3), while ETH, CERN, UCPH and KU Leuven conducts these activities by way of their internal TTO-like structure.

### **4.3 University strategy and organization of knowledge transfer**

The strategy and goals of each university must be taken into account in order to select the right governance model, Shoen et al. (2014) concludes. The reality, however, is that the governance models have been developed in a much more haphazard way, being influenced by external forces and decisions (Geuna & Muscio, 2009). As described above, seven out of the eight case-studies, UiO being the exception, have classical, dependent internal TTOs or internal TTO-like organizations reporting to top management. The units are organized internally as a separate entity, but not as a “department” as seems to be a common model in the US (Markman et al., 2005). Our informants were all aware of the importance of single individuals in the build-up of the commercialization activities that have taken place over the last 20-30 years. The active support of presidents, provosts and

director generals is duly recognized. While some of the informants believed that a positive attitude towards innovation, entrepreneurship and commercialization were now permanent, a few expressed some uncertainty as to whether the attitude is perpetual.

As seven of the eight universities (including CERN) have internal offices for knowledge transfer integrated into their administrative system, the management of the commercialization activities is quite direct. In the Norwegian system, the TTOs are independent, with a mixed ownership (see e.g., figure 5-1 in Grünfeld et al., 2018). In only a few of the Norwegian TTOs does the partnering university have a direct or indirect majority ownership. Typically, regional health institutions, research institutes and public investment organizations are joint owners (Spilling et al., 2015). As an example, UiO owns 50 percent of Inven2 (while Oslo University Hospital owns the other half). As these TTOs are limited companies, the management and influence of the owners must be in line with the Companies Act<sup>35</sup>. A Norwegian university that wants to influence the activities of their TTO collaborator must do so by way of board actions. This way of managing an organization is designed for arm-length distance and autonomy. Thus, the direct influence of Norwegian universities on their collaborating TTOs is characterized as weak.

The internal TTOs are not organized as for-profit organizations. However, the external partner(s) of the internal TTO may be for-profit. Parts of U-TUM seem to fit this description (three out of the four companies constituting U-TUM are for profit).

#### **4.3.1 Strategy for commercialization**

All of the institutions that we have visited have strategies for commercialization or something similar. They also have separate IPR policy documents. For some of the organizations, commercialization has been part of their activities for many years (e.g., the Leuven Research and Development (LRD) was established already in 1972, probably being the first such organization in Europe; Geuna & Muscio, 2009). In Norway, this kind of work is very recent. UiO established an IPR strategy in 2004, while the rest of the universities did so

<sup>35</sup> <https://lovdata.no/dokument/NL/lov/1997-06-13-44>

following a recommendation from the Norwegian Research Council in 2008 (Spilling et al., 2015). Similarly, in terms of support from top management, the Norwegian universities have only recently appointed an administrative director or pro-/vice-rectors responsible for innovation (e.g., prorector for innovation in 2009 as the first at NTNU - Norwegian University of Science and Technology; Spilling et al., 2015). UiO appointed a vice-rector for (research and) innovation for the first time in 2017.

Grünfeld et al. (2018) concluded, “The five (Norwegian) universities with associated TTOs

that we have looked at have substantial common features, but also marked differences. Common to all is that there is ambiguity about the objectives of the commercialization work. The targets point in several directions, such as revenue, technology spread and reputation, and are to a small extent guided by measurable indicators. UiO (Inven2) seems to have come the longest in setting demands for commercial self-employment income, and Inven2 is in many ways the most commercially engaged player.<sup>36</sup>”

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<sup>36</sup> Our translation; original citation on page 53 in (Grünfeld et al., 2018)

# 5 Commercialization of research in Norway

In this chapter, we summarize the properties of commercialization of research in Norway.

We open the chapter with highlights from an evaluation that Simula conducted in 2016, comparing the results and effectiveness of the Norwegian TTOs and *Simula Innovation*. This investigation was limited to one type of commercialization – spin-out companies. Nevertheless, the results show that the effectiveness of the Norwegian TTOs was comparatively low. In section 5.2, we explore in more detail some of the unique features of the Norwegian system for commercialization. Finally, in section 5.3, we use a theoretical approach to discuss how these unique features might constitute challenges to the ability of commercializing research in Norway.

## 5.1 Results of commercialization in the Norwegian system

In 2016, Simula conducted an evaluation of the TTOs in terms of their ownership of spin-out companies and their effectiveness. Included in this evaluation were *Simula Innovation*, Simula’s organization for the management of spin-out companies, and seven university TTOs, which were receiving support from FORNY2020. In 2014, these eight units managed 123 portfolio companies<sup>37</sup> with a total income of NOK 473 million. Figure 5, which is taken from this evaluation Arge, (2016), illustrates how this portfolio divides into roughly 80% start-ups (companies with an income below NOK 5 million) and 20% of more mature companies.

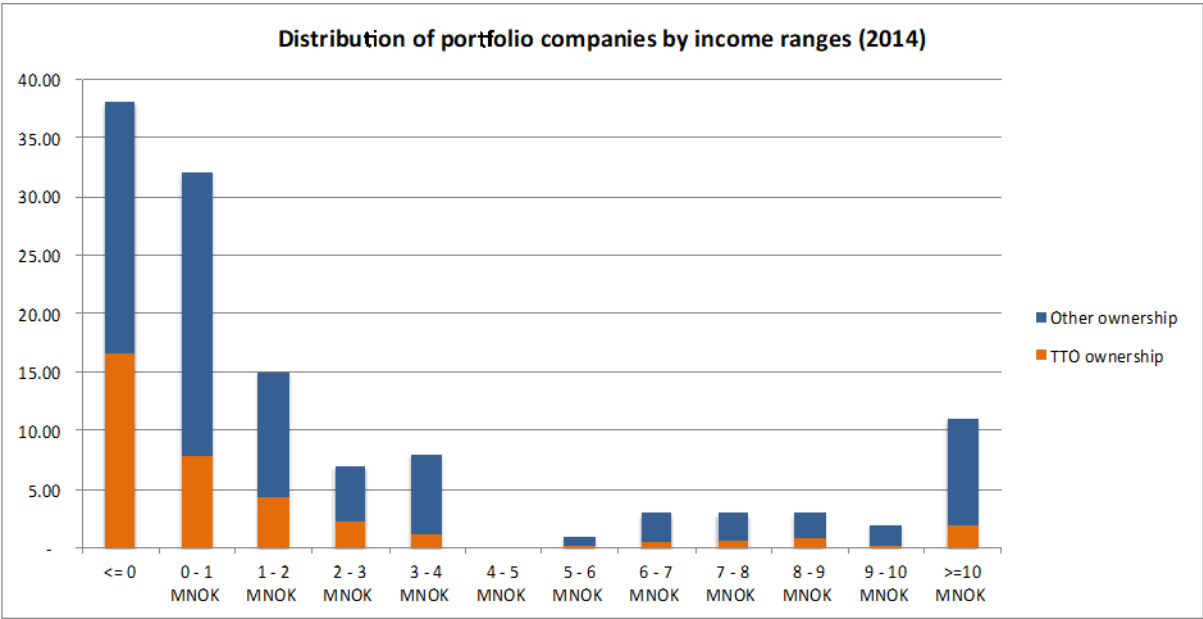


Figure 5. Distribution of portfolio companies in Norway by income ranges. The height of each column shows the number of companies with an annual income in the specified range. The proportion of the total shares of these companies owned by TTOs is shown in orange, while the proportion of total shares owned by actors outside of TTOs is shown in blue. Of the 11 companies with an income above or equal to NOK 10 million, TTOs own approximately 30% of the shares.

<sup>37</sup> The “portfolio companies” are the companies in which the TTOs have invested.



Furthermore, the mature companies generate around 80% of the total income and, accordingly, 20% of the income is generated by the early-phase start-ups. This situation remained remarkably stable from 2011 to 2014, with the 80% vs 20% ratio varying by less than 5% over this period.

Figure 6, also taken from Arge (2016), represents a ranking of the TTOs according to an index calculated from portfolio income, share ownership percentage and TTO operating expenses. The mean of the index for all TTOs is set to 100, thus the figure illustrates the relative score for the TTOs year by year. Technically, the index calculates the portion of the portfolio's income that "belongs" to the TTO in the sense of their ownership. Then this total is divided by the TTOs operating costs to arrive at comparable numbers. A TTO rises on the index with growing portfolio income and growing share ownership. It falls on the index with increasing operating costs. Thus, the index indicates those TTOs that are most successful relative to its resources.

We observe that *Simula Innovation* strongly outperforms the university TTOs in effectiveness. This is partly due to the very small administration of *Simula Innovation* and correspondingly very large administrations of the university TTOs. However, the absolute numbers also indicate that the quite large

university TTOs do not manage much equity, which is in line with other investigations that demonstrate that TTOs, generally, are not influential in stimulating the spin-out of research in to commercial companies (Clarysse, Wright, Lockett, Van de Velde, & Vohora, 2005).

## 5.2 Norway, the outlier

The observations from this investigation clearly point to the Norwegian system of TTOs as an outlier compared to the systems for commercialization in the other countries that we have visited and observed from the literature.

Firstly, knowledge transfer in Norway is organized by autonomous Technology Transfer Offices (TTOs), which differs strongly from the other countries included in this investigation. In contrast to all other institutions, UiO (and other Norwegian universities) have outsourced the entire commercialization process to the TTOs. All other universities have some kind of unit (classical internal TTO or similar) that manage the IPR of the university and decide the commercialization strategy for the IP. We are not aware of any other European university that organizes their commercialization work in the same way as the Norwegian universities. To our knowledge, Israel is likely the only other Western country in which this model is found (Grünfeld et al., 2018).

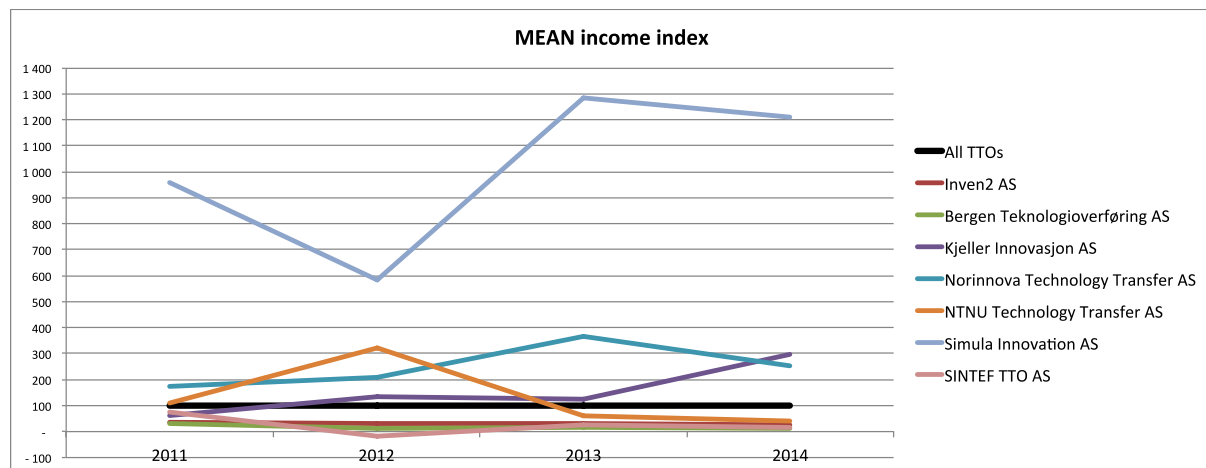


Figure 6 Relative ranking of TTOs for the period 2011 - 2014 according to the MEAN income index.

Secondly, commercialization is weakly integrated in the policy, administration and management of Norwegian universities (entrepreneurship and innovation in general is somewhat more visible). Until recently, only NTNU had a dedicated individual in top management responsible for innovation, a pro-rector for innovation; UiO has recently followed suit. Although commercialization is part of the general strategy of the universities, specific strategies for commercialization and IPR are difficult to locate on their webpages (or not easily found on their web-pages; Spilling et al., 2015 has documented that some of them actually exist). NTNU has a team of staff dedicated to innovation; such staff are not easy to find at the other Norwegian universities. As described in chapter 4, the management of the TTOs is weak and not integrated with the other activities of the universities.

Thirdly, the attitude towards commercialization among academics seems to be more negative in Norway than in the other countries we have investigated. We cannot find any recent weakening in the concept of contradiction between excellence and relevance (see chapter 6).

The output from commercialization of research in Norway is weak in comparison to other Western countries (Kunnskapsdepartementet, 2015). This could be due to a systematic failure (TTOs do not generally generate much surplus; Siegel & Wright, 2015). However, we believe that these weak results are a consequence of the shortcomings of the Norwegian system.

In summary, commercialization in Norway appears to be *sourced out* from the universities to the TTOs (Spilling et al., 2015, used the same term to characterize the relationship between the universities and the TTOs; page 56). This seems to result in a somewhat weaker impact, as the Norwegian universities take neither responsibility for nor a strong role in the commercialization of their results.

### 5.3 Challenges of the Norwegian system for commercialization

Successful commercialization results from a combination of mechanisms and qualities. To understand the success of Massachusetts Institute of Technology (MIT) in spinoff activities, O'Shea and coworkers (2007) argue that MIT's success is based on four factors: (1)

the science and engineering resource base, (2) the quality of research faculty (3), supporting organizational mechanisms and policies, and (4) the culture within academia that encourages entrepreneurship. They add, however, that historical context and the local and regional environment need to be considered. We will go through these four factors for Norwegian universities, starting with factor 4, continuing with factors 1 and 2 combined, concluding with factor 3.

#### 5.3.1 Culture for commercialization

The resistance in Norwegian universities to innovation, entrepreneurship and commercialization of research has been surprisingly strong for many years. As demonstrated in section 1.1, the obligation to contribute “to innovation and value creation on the basis of the results of research and academic and artistic development work” has been part of the law regulating universities for more than two decades. Governments of different political conviction have reinforced these same expectations, as have various policy bodies (e.g., the Research Council of Norway, as well as employers' organizations and employees' unions). The Ministry of Trade, Industry and Fisheries will evaluate and reform the supporting measures offered to industry, including research based value creation, during 2018-2020. It has also been repeatedly demonstrated that commercialization of research has a positive effect on research funding (Pitsakis, Souitaris, & Nicolaou, 2015; cited in Spilling et al., 2015) as well as for scientific productivity (Abramo, D'Angelo, Ferretti, & Parmentola, 2012; cited in Spilling et al., 2015). Furthermore, Grimaldi et al. (2011) found that “the rise of commercialization [...] has not resulted in less basic research”. Adding to this, there has been a considerable increase in basic funding for Norwegian universities over the last 20 years. Still, leading academics in Norway consider “that the pendulum has swung too far to the side of policies encouraging commercialization, to the point of endangering the open-science culture of universities and their reputation for good basic research” (Geuna &

Muscio, 2009)<sup>38</sup>. Spilling and coworkers (2015, p. 53) report that as individuals are exposed to successful and profitable commercialization the likelihood of more positive attitudes to commercialization of research increases. Also, with positive attitudes from management and colleagues the likelihood of participation in commercialization of research increases (several publications cited in Spilling et al., 2015, p. 53). There are signs that the culture is slowly changing.

The attitude towards innovation and entrepreneurship has been noticeably more positive over recent years. This is evident, firstly, as the use of the concept “innovation” has increased. Various formulations, including commercialization of research, have been included in most of the universities’ strategies. In addition, more universities offer education in entrepreneurship and innovation<sup>39</sup> than previously. NTNU has always had the most positive culture for these kinds of activities, and their best practices have spread.

### 5.3.2 The Norwegian science base for commercialization

All of the institutions that we visited were unanimous about the importance of the research base as the foundation for commercialization. In this respect, the methodology used by CERN to produce “value propositions” for collaboration with industry by identifying key technology and key competencies is an interesting case (see appendix A-4.1.2).

It is outside the scope of this investigation to undertake a comprehensive analysis of the commercial potential of the research at Norwegian universities. Rather, we will simply state two facts. Firstly, although Norwegian universities are not ranked among the very best universities in the international university rankings, they are nonetheless doing satisfactorily. Interestingly, there are several universities with lower academic rankings than UiO that are doing very well in the innovation rankings; in fact, five of the universities in Table 2 that rank higher than UiO overall have a lower ARWU ranking. Secondly, we know that there is a lot of high quality research conducted at

Norwegian universities, focused within areas that have the potential for large value creation in Norway (e.g., fisheries, energy and maritime sector) as well as internationally (e.g., ICT and life science). Our opinion is that the scientific basis for commercialization of research in Norway is sufficient.

### 5.3.3 Lack of a proper organization of commercialization

The most evident challenge of Norwegian commercialization of research is the supporting organizational mechanisms and policies (factor (3) in O’Shea et al., 2007). There is a clear lack of integration of commercialization in the core activities of the universities and the governance model of commercialization is weak.

**Lack of integration of commercialization in the universities’ core activities:** To succeed in the commercialization of research, innovation and commercialization must be integrated into the core activities of the university, and the university must have well-oiled connections to the innovation ecosystem surrounding the institution (Spilling et al., 2015). We have shown that commercialization of research at Norwegian universities is basically “outsourced” to the TTOs (section 4.2, *Organization of the TTOs* and section 4.3, *University strategy and organization of knowledge transfer*). As demonstrated by Grünfeld et al. (2018), there is ambiguity regarding the objectives of the commercialization work at all of the Norwegian TTOs. Furthermore, we have shown that there is weak internal strategy, culture and organization in the Norwegian universities to support and promote commercialization. The universities will then, inevitably, lack the competence in the organization to make the proper decisions about how to conduct commercial activities.

In order for Norwegian universities to succeed with commercialization, they must repossess substantial parts of the activities associated with the commercialization process. In particular, the universities must take control of the management of their IP. Consequently, the universities will need to build internal units with the necessary competency and capacity to manage IP. Furthermore, the universities will

<sup>38</sup> E.g., one of the leading Norwegian biologists at the University of Oslo, Dag Hessen, published the book «Sannhet til salgs» in 2018 (“Truth for sale”), discussing the pressure from demands on relevance on “free” academic research.

<sup>39</sup> E.g., <https://www.uio.no/english/studies/programmes/entrepreneurship-master/>

need to assign dedicated responsibility for innovation, entrepreneurship and commercialization to persons in top management, and they must continue to have such a responsibility clearly visible and prominent over time.

**The TTO model in Norway is not optimal:**

In this investigation we have demonstrated that the Norwegian TTO model for commercialization has several weaknesses. Most notably, the model provides the universities an opportunity *not* to take the proper responsibility for commercialization by “outsourcing” the commercialization activities. Additionally, there are three particular aspects of the autonomous TTO-model (Schoen et al., 2014) that give added reasons for concern.

Firstly, most of the Norwegian TTOs have an exclusive right to receive DOFIs (Disclosure of inventions) from a university. This means that the pathway through the TTO is the only way to commercialize an invention. The lack of alternatives can be problematic, as it places the power solely in the hands of the TTO.

Secondly, the TTOs have very rigid models for equity and division of income. The experience from Simula Innovation and other successful accelerators is that there is a need for a custom made and flexible approach to new inventions. Sometimes the need for capital and patience is warranted, while in other instances the need to move quickly is paramount.

Thirdly, the set-up of Norwegian TTOs favors one particular model of commercialization: the licensing model, in which the TTO retains the IP of an invention and sells the right to use it. There is nothing inherently wrong with the licensing model, and it seems to be especially well suited to life science, as demonstrated by UCPH. However, other models are often more appropriate and necessary (e.g., investing in a startup or trading IP for equity). A TTO or any other unit responsible for the actual spin out of the research should master multiple, distinct strategies for managing IP, and should be able to select and apply the appropriate strategy to a given situation. Furthermore, the TTO should adapt to changes in the process (e.g., open up for transfer of IP if that is needed to attract investors). Finally, although the licensing model minimizes the risk for the TTO, it leaves the inventors with few alternatives. We have seen how CERN emphasizes the importance of the know-how of their technology. In general, the ownership and economic incentives should be proportional to the effort/input to an innovation. Thus, if the scientists have contributed a lot of work, they should be rewarded. Similarly, if the TTO takes a considerable economic risk, it should be rewarded. The decoupling of the inventors and the risk takers from the TTO is potentially a weak point in the commercialization process.

## 6 Policy recommendations

In this chapter we detail the consequences of our findings and provide recommendations for a change of Norwegian policy for the commercialization of research.

### 6.1 Initiate a university strategy processes for knowledge transfer

We have demonstrated that the lack of a proper strategy for knowledge transfer can lead to weak and ineffective transfer of university research results to society. The Norwegian universities should develop specific and realistic strategies covering the whole field of knowledge transfer. Specifically, the university needs to position knowledge transfer in relation to their other core activities – research and education. These strategies must be based in the peculiarities of the universities, their history, their scientific profile and their regional environment. In particular, the universities should specify their goals for knowledge transfer and then organize their governance model accordingly. In this report, we have referred to how both CERN and UCPH have knowledge strategies that are not based on maximizing the income from IP. Variable models of governance structure and methods are both possible and desirable.

### 6.2 Dismantle the TTOs

We have shown that the organization and function of the Norwegian TTOs are unique among western countries.

In order to develop a better system for knowledge transfer in Norway, it is likely that the TTOs should be dismantled in their current form. As the TTOs are limited companies, this decision is up to the general assembly. However, the universities, the Research Council and other public bodies should no longer support the activities of the TTOs in their current form. Some of the TTOs could be transformed into organizations specializing in the final phase of commercialization of research (e.g., as U-TUM, Polyhub or II). However, after an initial

transition period, these organizations should be self-sustaining.

Various evaluations have concluded that the TTOs are not working as intended or should be reformed (Borlaug et al., 2009; Grünfeld et al., 2018; Spilling et al., 2015). One of the most recent evaluations, the “Menon-report” (Grünfeld et al., 2018) explicitly recommends a change in the organization of commercialization work in the HEI-sector of Norway: “We also believe it is time for a re-evaluation of the organization of the TTOs, and that there is a need to refine the ownership model to a greater extent - either in the form of the TTOs being fully integrated into the university or in the form of the TTOs being transformed into organizations where the ownership and governance of the HEI institutions is sharply toned down.”

The quite considerable funding that is currently channeled into the TTOs<sup>40</sup> could be used to assist the universities in building internal units for the commercialization of research (see next section). However, no additional money should be spent for creating new internal units for commercialization; rather, (parts of) the current funding allocated to independent TTOs should be redirected. This would reduce and eventually deplete external funding for independent TTOs. The Norwegian TTOs are currently very large organizations proportional to their results (Arge, 2016). Table 3 shows the number of employees in the Norwegian TTOs. Such a reform as suggested here should not lead to an increase in the total number of people working with commercialization for the universities.

<sup>40</sup> The Research Council spent NOK 130 million (about €13 million) on TTOs in 2015 (Arge, 2016).



Name	Number of employees
Ard Innovation AS	8
Vis - Vestlandets Innovasjonsselskap	68
Innoventus sør AS	8
Inven2 AS	36
Kjeller Innovasjon AS	11
Nord Innovasjon AS	0
Norinova technology Transfer AS	20
NTNU Technology Transfer AS	33
Sintef TTO AS	8
Validé AS	21
Total	213

Table 3. The number of employees in the Norwegian TTOs in 2018. The TTOs retrieved from <https://www.forskningsradet.no/en/apply-for-funding/funding-from-the-research-council/Support-commercialisation-research-results/> 20. September 2019.

### 6.3 Establish knowledge transfer units within the universities

The Norwegian universities are the only universities we are aware of that do not have internal units responsible for commercialization. We believe this is a serious weakness of the Norwegian system (see chapter 5).

The Norwegian universities should establish internal units responsible for the commercialization of research, possibly in combination with related activities. These units should be integrated into the administration of the university and report to a dedicated person in the top management. These units should not be established in addition to the external TTOs, but rather as an alternative. As such, the universities should no longer fund activities in independent TTOs.

The Research Council of Norway should support the establishment of such units in the initial phase (see previous section). This is in line with development in other countries, as a “wider range of universities have recently taken formal steps to invest in the creation of internal organizational structures and support mechanisms, with the intention of speeding up

the process and encouraging commercialization that may otherwise not have occurred,” (Grimaldi et al., 2011). The evaluation conducted by Spilling et al. (2015) similarly recommends that the integration between the TTOs and the universities should be much stronger.

### 6.4 Create a heterogeneous system for commercialization of research

Financial support for TTOs has been more-or-less the only strategy for strengthening commercialization at Norwegian universities.

A future system for the commercialization of research should avoid exclusivity for a certain type of organization. The universities should look for a variety of partners and approaches for transferring their knowledge and technology to society. If we are truly looking for innovative solutions and new applications, we should also look for new ways of translating knowledge for societal use.

### 6.5 Commercialization is just one part

Even though this report argues strongly for the importance of commercialization and proposes some drastic measures, we strongly recommend that the two other core activities – research and education – must continue to be of the highest priority. Following Grimaldi et al. (2011), “at the system level, there is a need to move beyond expectations that all universities need to address all aspects of knowledge and technology transfer equally.” Commercialization is not the only aspect of the third mission (Gulbrandsen & Slipersaeter, 2007; Laredo, 2007); innovation, entrepreneurship and outreach are just some of the other activities included in the third mission. This report, however, has focused on commercialization and has documented serious shortcomings in current practices in Norway. We believe that both the universities and industry will benefit from a better system of commercialization.

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## **Appendix 2      List of abbreviations**

ARWU	Academic Ranking of World Universities (the “Shanghai Ranking”)
CERN	The European Organization for Nuclear Research
DOFI	Disclosure of invention
EIU	“Europe's Most Innovative Universities”
ETH Zurich	Swiss Federal Institute of Technology in Zurich
EU	The European Union
GIU	“Global Innovative Universities”
HEI	Higher education institution
II	Imperial Innovations
Imperial	Imperial College London
IP	Intellectual property
IPR	Intellectual property rights
KU Leuven	Catholic University of Leuven
OECD	Organisation for Economic Cooperation and Development
Polimi	Politecnico di Milano
R&D	Research and development
TTO	Technology Transfer Office
TUM	Technical University of Munich
UCPH	The University of Copenhagen
UiO	The University of Oslo
U-TUM	The UnternehmerTUM

## **Appendix 3    Interviews and meetings**

The following people supplied information during site visits:

### **A-3.1    Switzerland**

#### **A-3.1.1            ETH Zurich, 10 April 2018**

Dr. Anita Buchli, Head Strategic Development

Ms. Julie Cantalou, Strategic Processes, Strategic Development

Dr. Zhenzhong Su, Pioneer Fellow, CEO & Co-founder Fixposition

Dr. Phillipp Furler, Pioneer Fellow

Dr. Andreas Klöti, Head of Team Industrial Collaborations

Dr. Urs Zuber, Head Industry Relations

Dr. Marjan Nienke Kraak, Head of ETH transfer Spin-off Support

Ms. Hanna Brahme, Technology Transfer Manager, ETH transfer Spin-off Support

#### **A-3.1.2            CERN Knowledge Transfer Group, 26 June 2019**

Dr. Giovanni Anelli, Group Leader Knowledge Transfer Group (IPT-KT)

Mr. Han Dols, Section Leader Business Development Section, Business Development Section (IPT-KT-BD)

Mr. Nick Ziogas, Knowledge Transfer Officer, Business Development Section (IPT-KT-BD)

Ms. Amy Bilton, Knowledge Transfer Officer, Business Development Section (IPT-KT-BD)

Ms. Ranveig Strøm, Entrepreneurship Development Officer, Knowledge Transfer Group (IPT-KT)

### **A-3.2    Denmark**

#### **A-3.2.1            University of Copenhagen, 4 January 2018**

Professor Thomas Bjørnholm, Prorector for Research and Innovation

Mrs. Karen Laigaard, Head of Technology Transfer

### **A-3.3    Belgium**

#### **A-3.3.1            KU Leuven, 22 January 2018**

Mrs. Veerle Cauwenberg, head of Industrial Research Fund



### **A-3.4 Germany**

#### **A-3.4.1 Technical University of Munich, 30 October 2018**

Dr. Alexandros Papaderos, Deputy Head of the Office for Research and Innovation and Head of Patent and Licensing Office, TUM ForTe - Office for Research and Innovation, Technical University of Munich

### **A-3.5 Great Britain**

#### **A-3.5.1 Imperial College, 1 March 2018**

Dr. Pushkar Wadke, Associate Director, Technology Ventures

Dr. Dimitris Sarantaridis, Industry Partnerships and Commercialisation Senior Executive, Engineering, Corporate Partnerships

Mrs. Vicky Kilcoyne, Associate Director (Commercial Development), Academic and Enterprise Ventures, Research and Innovation

### **A-3.6 Italy**

#### **A-3.6.1 Politecnico di Milano, 17 January 2019**

Dr. Beatrice Saglio, Technology Transfer Manager, TTO Office of Politecnico Milano

Mr. Mauro Croce, Space Manager & Program ambassador, Polihub Startup District & Incubator

### **A-3.7 Norway**

#### **A-3.7.1 University of Oslo, 14 May 2019**

Vice-rector Professor Per Morten Sandset

Pro-dean Professor Mathilde Skoie, Faculty of Humanities

Vice-dean Professor Linda H. Bergersen, Faculty of Dentistry

Vice-dean Professor Tim Brennen, Department of Psychology

Associate Professor Jan Terje Andersen, Department of Pharmacology

Associate Professor Jens Petter Falck, Senior Advisor – Entrepreneurship, Department of Informatics

Director UiO:Life Science, Professor Carl Henrik Gørbitz

Director UiO:Energy, Dr. Vebjørn Bakken

Professor Magnus Gulbrandsen, Centre for Technology, Innovation and Culture

Director of Department of Research Administration, Dr. Kristel M.J. Skorge

Senior Adviser Vibeke Alm, Research Support Office

Senior Adviser Ivar Bergland, Research Support Office

## Appendix 4 Notes from Interviews

**Disclaimer.** *Facts have been checked with our hosts at the various organizations. However, the author is entirely at fault for any misinterpretations or mistakes.*

### A-4.1 Switzerland

#### A-4.1.1 ETH Zurich

(Swiss Federal Institute of Technology in Zurich; German: Eidgenössische Technische Hochschule Zürich)

<https://www.ethz.ch/en.html>

*“Freedom and individual responsibility, entrepreneurial spirit and open-mindedness: ETH Zurich stands on a bedrock of true Swiss values.”*

Established in 1855

Ownership: Federal government

Key figures (2016)<sup>41</sup>:

- Budget: CHF 1,768 million (about NOK 15 billion), 73% federal contribution.
  - 3,457 technical and administrative staff
  - 509 professors
  - 5,843 scientific staff total
  - 9,100 Personnel total (FTE)
- Structure:
  - 16 departments
  - 5 core strategic focus areas: Medicine, Data, Sustainability, Manufacturing technologies and Critical Thinking Initiative
  - college clusters (with university colleges) with 54,425 students
- Education: 19,815 students (2016), 4100 PhD-students. 38% international, 31% female
- Innovation: Approximately 90 patent applications and 200 invention disclosures every year. 25 spin-offs in 2016 (10 by Pioneer Fellows). 382 spin-offs since 1996.

**Notes from our meeting with Dr. Anita Buchli, Julie Cantalou, Dr. Zhenzhong Su, Dr. Phillipp Furler, Dr. Andreas Klöti, Dr. Urs Zuber, Dr. Marjan Nienke Kraak and Hanna Brahme**

#### Background

ETH is consistently ranked among the top universities in the world. In the 2019 edition of the QS World University Rankings ETH Zurich is ranked 7th in the world (3rd in Europe after Oxbridge), and is also ranked 10th in the world by the Times Higher Education World Rankings 2018 (4th in Europe after Oxbridge and Imperial College London). In the 2018 QS World University Rankings by subject it is ranked 4th in the world for engineering and technology (2nd in Europe), and 1st for Earth & Marine Science. As of 2017, 32 Nobel Prizes winners, 4 Fields Medalists, and 1 Turing Award Winners have been affiliated with the Institute, including Albert Einstein.

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<sup>41</sup> <https://www.ethz.ch/en/the-eth-zurich/portrait/eth-zurich-in-figures.html> and ETH Zurich Annual Report 2016; [https://www.ethz.ch/content/dam/ethz/main/eth-zurich/Informationsmaterial/ETH\\_GB16\\_EN.pdf](https://www.ethz.ch/content/dam/ethz/main/eth-zurich/Informationsmaterial/ETH_GB16_EN.pdf)

The president of ETH Zurich bears legal and political responsibility for the university and is accountable to the ETH Board for its management. The Rector is responsible for education within the Executive Board. There are Vice Presidents for Research and Corporate Relations, Finance and Controlling and Human Resources and Infrastructure. The president is appointed by the Federal Council (Swiss government) upon proposition by the board and appoints the Vice presidents. The rector is elected by the professors and proposed to the President for nomination by the ETH Board.

ETH is a “mini Switzerland”: The structure is in general very flat, with a lot of autonomy of professors and departments. ETH has a strong academic governance, and the administration is not a very powerful coordinating force. The decision making process is characterized by a lot of consultations. This is, however, the way decisions are made in Switzerland, and no informants raised the decision process as a problem.

### **Innovation system of ETH Zurich**

1. *Research Base:* The first priority of ETH is still the education of engineers. Still, ETH is one of the strongest research universities in Europe. The conditions for executing research are very favorable at ETH. Professors are well equipped and have a high degree of freedom.
2. *Integration of research and commercialization:* In the hiring process, ETH asks for 5 major achievements, not just the best publications. The expectations from the management is that professors engage in both, and most are. Research and commercialization are not perceived as competing activities.
3. *Internal support:* Commercialization activities are supported through the various parts of ETH transfer.
4. *Alumni.* Being the premiere Swiss university with an active network of alumni, this ensures close interactions and contacts with industry.

### **Organization of commercialization/innovation**

- ETH transfer is the technology transfer office of ETH Zürich. ETH transfer reports directly to the Vice President Research and Corporate Relations. Commercialization is thus integrated in the core organization of ETH. The integration is mostly an advantage – it secures direct connection to the senior management. The disadvantage is the implicit dependency on the vice president.
- The activities of ETH transfer are organized in four groups: Spin-off Support and Pioneer Fellowships (lead by Kraak), Innovation and Entrepreneurship Lab, Research Contracts (lead by Klöti) and Patents, Licenses and Software Licenses.
- Interaction with industry and alumni, headed by Dr. Urs Zuber. Annual industry days and other alumni-oriented activities. ETH organizes industry days with several hundred participants from a range of industries. Furthermore, ETH spends considerable resources maintaining contact with its Alumni<sup>42</sup>, in addition to the more informal contact between faculty and Alumni.

### **Organization of the TTO/commercialization pipeline**

- ETH transfer supports the ETH community in all questions relating to research contracts with industry, inventions, patent applications and licensing. ETH transfer supports young entrepreneurs in the early stage of founding their own companies.
- Licensing revenues – distribution of income: At ETH Zurich, the inventors participate in the income derived by ETH Zurich, for instance by licensing an invention or other intellectual property. The first revenues that ETH Zurich obtains will initially be used to cover the costs of patenting and marketing (e.g. for patent

<sup>42</sup> <http://www.alumni.ethz.ch/en/about-the-alumni-association.html>

attorneys). The remaining income will, as a rule, be distributed as follows (subject to any financial claims by a third party):

- 1/3 to the inventor(s)
  - 1/3 to the responsible professorships for further research purposes
  - 1/3 to ETH Zurich
- Entrepreneurship: ETH conducts a comprehensive range of activities, including support for spin-off activities and partnering a wide range of local, regional, national and international organizations of relevance for entrepreneurs.
- Young entrepreneurs: ETH offers a wide range of activities to stimulate young entrepreneurs. However, two activities stand out:
  - The **Pioneer Fellowship Program** offers up to 18 months of support (k€142) for ETH talents who want to pursue an entrepreneurial career, along with an extensive mentoring and training program.
  - The **ieLab** (Innovation & Entrepreneurship Lab) hosts the Pioneer Fellowship Program and offers a comprehensive program of services, educational programs, networking opportunities and individual coaching for outstanding young researchers with entrepreneurial ambitions.
- Support for technology transfer. ETH has an extensive support system for technology transfer of various kinds, including legal and IP support. The activities of Industry relations appear to be extensive at ETH.

### **How to promote innovation?**

- ⇒ “It all starts with contacts”, seem to be the thinking of ETH. The Industry Relations team organize a wide range of activities facilitating contact between industry and ETH research. The ETH Foundation is an independent, non-profit organization, under private law, with the aim of promoting teaching and research at ETH Zurich. The ETH Foundation seem to be a key partner in mobilizing industry for collaboration with ETH.
- ⇒ Entrepreneurship is stated be an integral part of the ETH Culture. ETH does not set commercial goals. However, achievements of various kinds of technology transfer is monitored and reported.

### **Conclusions: Why does ETH succeed in commercialization?**

- ⇒ ETH offers good conditions for research, with generous funding and high autonomy
  - ⇒ ETH provides good models for collaboration with industry
  - ⇒ Switzerland has liberal laws and many SMEs that take part in innovation activities
  - ⇒ Generous funding of collaboration with industry from federal government
-

### A-4.1.2 CERN (The European Organization for Nuclear Research)

(<https://home.cern/>)

*"Science for peace"*

Established in 1954 by 12 founding member states.

Ownership: International, currently (2019) 23 member states

#### Key figures:

- Total expenses: CHF 1,232 million (2017<sup>43</sup>).
  - About 2,500 staff members, less than half scientists and a third technical staff
  - 10-13,000 scientist at any time
- Contributions from member states and associated members (2019)<sup>44</sup>: CHF 1.146 billion (about € 1.03 billion or about NOK 9.9 billion), constituting almost all revenue.
- Structure:
  - 6 science departments
  - A complex of various particle accelerators
- Education: About 2700 PhD students took part in analyses at CERN in 2017.
- More than 300 scientific papers were published in 2017.
- Innovation: About CHF 2.5 million (~€ 2.2 million) income from licenses etc. Key figures for 2018<sup>45</sup>: 77 internal disclosures, 44 knowledge transfer contracts, 28 spin-offs and start-ups using CERN technology

#### **Background**

CERN is a unique research organization in Europe. The organization was created in the aftermath of WWII to facilitate world-class research in fundamental physics. The CERN initiative must also be understood as a means to rebuild scientific capacity in Europe. Since then, CERN has become a model for international collaboration.

The activities of CERN are strongly determined and constrained by their charter/the CERN convention and the interest of the member states. The CERN convention states: "The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available." Thus, CERN does not contribute scientifically to the military. Over the course of their history, CERN has made some major contributions to society. Technology from the physics experiments has been instrumental in communication technology, medical technologies and aerospace, to mention a few. CERN is also famous as the cradle for the World wide web (Sir Tim Berners-Lee, together with a CERN colleague, Robert Cailliau in 1990).

#### **Notes from meetings with Dr. Anelli, Mr. Dols, Mr. Ziogas, Ms. Bilton and Ms. Strøm:**

##### **Innovation system of CERN**

The CERN convention does not explicitly provide guidelines for innovation and commercialization. However, the latter part of the sentence cited above ("the results of its experimental and theoretical work shall be published or otherwise made generally available") provides a justification for knowledge transfer work.

The 23 member states of CERN expect a fair return of their investments. In implementing commercialization activities, the staff of CERN must always take care not to favor certain, or a few, member states. This is also a strong consideration when CERN conducts procurements. The size and technical level of the procurements of CERN make the contracts very attractive.

<sup>43</sup> <https://home.cern/sites/home.web.cern.ch/files/2018-06/AnnualReport2017EN.pdf>

<sup>44</sup> <https://en.wikipedia.org/wiki/CERN>

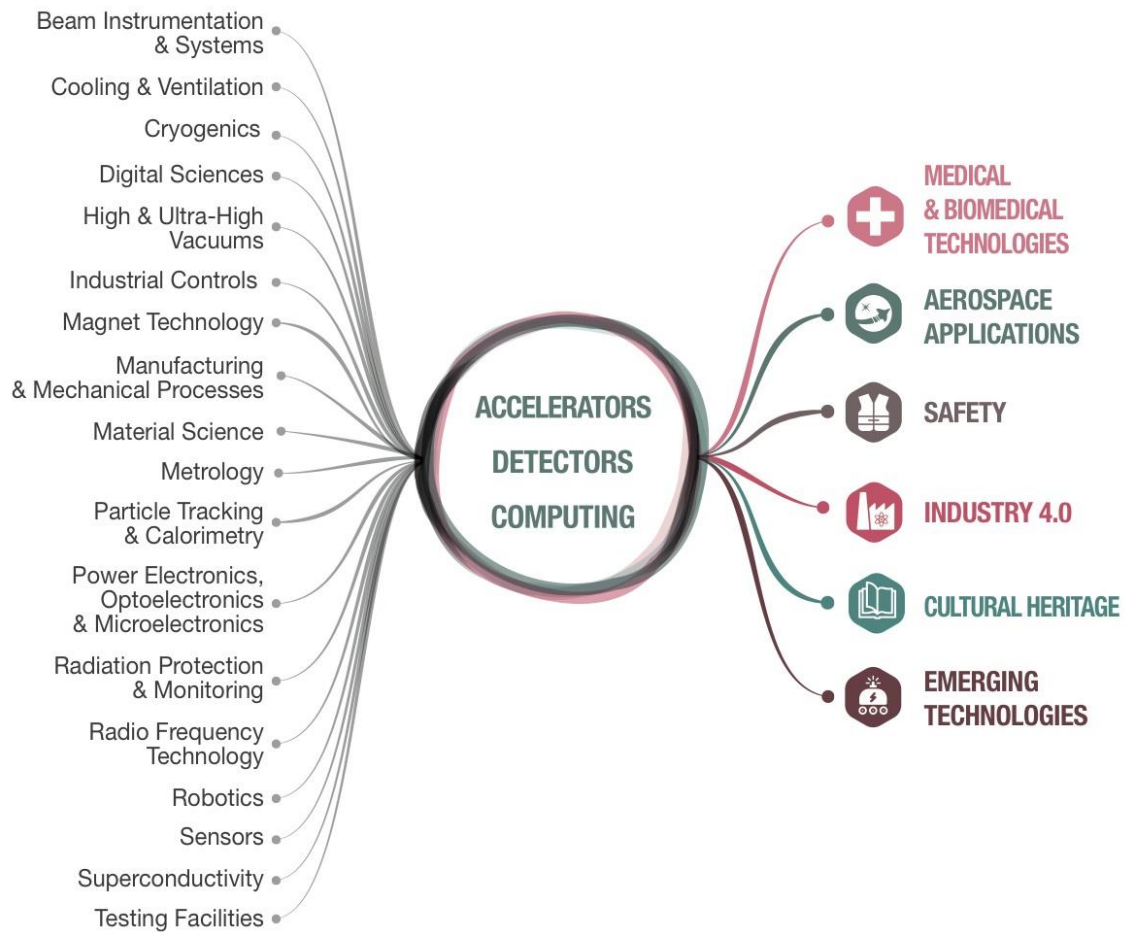
<sup>45</sup> "Knowledge Transfer 2018"



The considerations about fair return and the idealistic nature of CERN have led to an approach to knowledge transfer that is quite cautious. The goal is not to make a profit, but to transfer knowledge to society. Consciously or not, CERN use the term “knowledge transfer” about their work instead of the more common “Technology transfer”. The aim of knowledge transfer is “to maximize the positive global impact of CERN on society”.

### Organization of commercialization/innovation in CERN

knowledge transfer is organized as a separate unit (“KT”), led by Dr. Giovanni Anelli, providing a wide range of services. The fundamental thinking of KT is neatly summarized in the following figure:



Fundamentally, CERN develop and build accelerators, detectors, and the computational algorithms, software and hardware necessary to analyze the outcome of the experiments (central circle in the figure).

Realizing that a general model of technology push did not work satisfactorily, KT initiated a process of defining “value propositions” for about 20 scientific fields (left in figure). For each of these scientific fields, the unique position of CERN is described, and key competencies and key technologies are identified. These value propositions have then been used as the fundamental input for CERN to contribute to selected application fields (right part of figure).

This way of thinking has been developed in collaboration with industry and other partners and provide a framework to conduct knowledge transfer work.

### **Collaboration with industry**

In line with the peculiarities of CERN, contact with industry must be conducted across member states. Members of KT reach out, e.g., at international conferences and organize targeted discovery days for companies visiting CERN. The main idea is to couple the challenges of the companies with the key technologies and/or know-how of CERN.

### **Innovation and commercialization modes of CERN**

CERN has moved away from a general “rule-based” model of patents and licensing. Instead, a tailor-made model is adopted. Each potential innovation is scrutinized and the appropriate strategy is chosen. E.g., some of the technologies developed at CERN is so specialized, that it is fundamentally impossible to copy the technology without the know-how of CERN. The need for protecting these kinds of technologies (e.g., by patents) is thus lower. For a lot of the technology developed within ICT the model of CERN is open science and open source, thus offering an alternative to proprietary solutions dominating the global market. In other instances, albeit fewer than before, KT make sure that technologies are patented.

### **CERN Culture**

The culture of CERN is very much oriented towards fundamental research. Innovation and commercialization is not a strong priority for the scientists, nor for most of the member states. KT thus seems to have adopted models that minimize the effort from the scientists in the knowledge transfer process.

### **How to promote innovation?**

- ⇒ General support-system for IPR etc., events and outreach, and cross-member state networks.
- ⇒ Partners at CERN, e.g., Ideasquare and CERN Openlab (Makerspace/open lab/accelerator)
- ⇒ The CERN knowledge fund and the CERN Medical applications budget provide seed funding to research groups to develop how to transfer research to society. To secure the research base of the funding, the department heads select projects in collaboration with the KT

### **Conclusions: Why does CERN succeed in knowledge transfer?**

- ⇒ The technology of CERN is unique and very few institutions (in Europe) have the critical mass to develop know-how and technology as deeply and conclusively as CERN.
  - ⇒ The model of knowledge transfer seems very well understood and the framework to conduct knowledge transfer is well developed and well fitted to the nature and culture of CERN.
-

## A-4.2 Denmark

### A-4.2.1 University of Copenhagen (UCPH)

(<http://www.ku.dk/english/>)

*"A world-class university"*

Established in 1479

Ownership: Public

Key figures<sup>46</sup>:

- Revenue: DKK 8.9 billion (about € 1.2 billion, about NOK 11.4 billion). About 58% basic funding (24% education, 34% research)
  - 9 348 FTE staff members
  - 4 856 scientists
- Structure: Six faculties (Health and medical science, Humanities, Law, Science, Social science, and Theology), 35 departments and more than 200 research centers over four campuses in Copenhagen city
- Education: 38,324 students, about 5% international
  - 3,086 PhD students, 811 approved dissertations.
- Research spending: DKK 3.8 billion (about € 0.5 billion, about NOK 4.9 billion).
  - Forty-four percent of around 5000 research grants from private funders.
- Innovation (2016)<sup>47</sup>: Total spending of DKK 5.7million, total income of DKK 6.5 million. Net profit DKK 0.8 million (€ 0.1 million). Income from licenses etc.:
  - 13 FTE working with tech transfer
  - 88 Disclosure of inventions, 50 retained by the university
  - 28 license agreements (steady rise from 13 in 2009)
  - 5 spin-outs (5 in 2015, but 3 in 2017)
  - Collaboration agreements with IP: 810 (steady rise from 573 in 2009)

#### Background

The University of Copenhagen (UCPH) is the highest-ranking university in Denmark and often the highest-ranking University in the Nordic Region (highest on the ARWU, but number 5 on THE). UCPH is one of the oldest universities in Europe. Nine Nobel Prizes have been awarded to researchers at the University.

In 2000 the governance structure changed from the traditional collegial form of government to a government appointed board with a majority of external representatives hiring the rector.

#### Notes from meeting with Professor Bjørnholm and Mrs. Laigaard

##### Innovation, business collaboration and commercialization

To understand UCPH today we must understand the history:

Important (governmental) reforms: Tech transfer 2000, leadership reform of 2003 and mergers induced important changes:

- University Rector employed instead of being elected => Real leadership
- Funding moved from internal base funding to external competitive funding
- Merger: Two applied institution merged with UCPH (2007). Leadership challenge: How to combine the strong academic quality of (the original) UCPH with the applied attitude of the other two institutions.

⇒ Leadership challenge: A big cultural change from the old internally oriented thinking in the university world, to a more externally oriented thinking and attitude.

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<sup>46</sup> From <https://about.ku.dk/facts-figures/>, July 2019. Numbers for 2018 unless otherwise noted.

<sup>47</sup> From presentation at site visit.

- ⇒ Strong private funding of basic research: The ten largest private companies spend a lot of their profit on research. Today, more than public funds!

### **Innovation system of UCPH**

1. *Fundamental*: The institution of high scientific quality and international visibility to attract talent and investments (e.g., Venture Capital)
2. *The knowledge*: The science, the knowledge, the result is the raw material that will be transformed (Tech transfer) to
3. *Impact*: UCPH aims to have an impact economically, culturally, and on (the structure of) society
4. *Tech transfer*: The most important vehicle of tech transfer is the candidates (“90%”), while other vehicles of transfer is publications, collaboration with external stake holders and commercialization (TTO, Spin-out etc.)

### **How to promote innovation?**

The management has initiated many measures to promote innovation and foster a new way of thinking:

- Innovation price: Displays people who both publish internationally and excel at commercialization.
- Ambassadors on the faculties
- Collaboration with the Danish innovation fund
- Part of the HR-work: Check efforts and results within innovation
- Inspiration from UK: Evaluation of the impact and use of external funding.

### **Organization of commercialization/innovation**

- The “Greater Copenhagen” framework has been an important driver:
  - Close link between the city and the HE-institutions
  - UCPH, DTU (Technical University of Denmark) and CBS (Copenhagen Business School) meet 4 times a year about Greater Copenhagen
  - Such initiatives must engage all three of Industry, Politics and Universities.
  - Other initiatives were not able to engage all three (i.e., The Øresund concept and the Medical Valley initiative]. Still hard to engage with possible Swedish partners in Malmö/Lund.
- Invested, competent and strategic leadership important to foster commercialization
- The Tech Transfer Office (TTO) is “responsible for ensuring that society benefits as much as possible from inventions made at University of Copenhagen (UCPH) and the hospitals in the Capital Region of Denmark”.
- The TTO is part of the management structure of UCPH (while e.g., the Norwegian TTOs are independent limited companies)

### **Organization of the TTO/commercialization pipeline**

- Integrated part of the management of UCPH
- *Tech transfer* is the purpose – not to earn money etc.
- About 70 inventions are submitted per year => About 30% are admitted to the TTO, resulting in about 20 licenses/year and 2-3 spin-outs a year. Goal in 2023 respectively 150-200 inventions and 10-15 spin-outs per year.
- UCPH TTO: Traditionally do not take shares, but licenses
- Active collaboration with the large private companies of Denmark that often use these licenses. Main responsibility of TTO to negotiate the conditions. Good collaboration.
- UCPH TTO: Administers Proof of Concept scheme: DKK 4 mill/year, up to 0.5 million for Proof of concept process.

- Common platform with TTOs of other leading universities of Europe (ASTP, Association of European Science and Technology Transfer Professionals)

### Conclusions

- ⇒ A strong, internationally competitive scientific basis is fundamental to succeed in commercialization.
  - ⇒ Dedicated (competent and strategic) leadership important to foster commercialization
  - ⇒ The UCPH TTO is an integrated part of UCPH, and not an independent limited company
  - ⇒ The prioritized output from UCPH TTO is licenses
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## A-4.3 Belgium

### A-4.3.1 KU Leuven (Catholic University of Leuven)

(<https://www.kuleuven.be/english/>)

*“KU Leuven is an institution for research and education with international appeal. All programmes at this University are based on the innovative research of its scientists and professors. KU Leuven ranks among the best 50 universities worldwide!”*

Established in 1425

Ownership: Private

#### Key figures:

- Budget: € 933 million in 2014 (about 10 billion NOK)
  - 3,364 technical and administrative staff (2015)
  - 1190 professors and 5,767 researchers (2015)
- Structure:
  - 14 faculties
  - 5 college clusters (with university colleges) with 54,425 students
- Education: 55,523 students (2015-2016), 16% international
- Research: €466 million
- Innovation: €122 million income from licenses etc. In 2015: €188 million. In 2005-2014 total income of €1.4 billion (Grünfeld et al., 2018).

## Notes from meeting with Mrs. Cauwenberg

### Background

KU Leuven is one of the oldest universities in Europe. The university has a strong academic tradition, and scores high in several academic rankings (e.g., 40th in Times Higher Education ranking). KU Leuven has succeeded in 92 ERC grants, more than one third of the Belgian grants. KU Leuven is one of five universities in Flanders, and one of three private universities. The five universities enrolled about 82,000 students in 2011, while 22 university colleges enroll another 125,600 students (de Boer, 2013).

Flanders has been leading in many of the recent reforms in Europe. However, the universities have retained the autonomy to decide their internal structure. KU Leuven has a rector elected by all professors and representatives of other categories of staff and students for a four-year-term, while the General Manager is appointed for a renewable four-year term (de Boer, 2013).

Leuven Research and Development (LRD) was founded in 1972 and incorporated in the university in 1985. For the last few years KU Leuven has been considered the most innovative university of Europe<sup>48</sup>. The annual revenue of KU Leuven from commercial activities is about €122 million; they have about 110 spin-outs, adding about 6 per year. Over the past decade they have raised more than €874M in private capital to the spin-outs, on average close to €8M per spin-out!

### **Innovation system of KU Leuven**

1. *Research Base*: KU Leuven is strongly competitive. 19% of funding is internal (i.e., base funding).
2. *Integration of research and commercialization*:  $\frac{3}{4}$  of the professors have contracts through LRD.
3. *Internal support*: Research Coordination Office supports the academic staff.
4. *Industrially funded research*. Around 25% of KU Leuven's research funding comes from industry, with a combination of applied and basic research activities being funded.

### **Organization of commercialization/innovation**

- LRD is the organization responsible. LRD is part of the university, and is the oldest commercialization unit in Europe (Geuna & Muscio, 2009)
- The executive director of LRD is the General Manager (i.e., Professor Koenraad Debackere). This ensures heavy management dedication. The administrative dedication is more important than the (elected) academic dedication.
- From the university side, the support system is organized under "Research policy" and lead by one of the (eight) vice-rectors. The DOC – Research Coordination Office is the operational unit, and collaborates closely with the LRD.
- Divisions - horizontal structure – which serves as a "bank account" and all income from external sources are saved there. This money can be distributed to support research or to push technology higher on the TRL, and develop business. Autonomy to distribute these funds

### **Organization of the TTO/commercialization pipeline**

- An important modus of operation for the commercialization process is long incubation time. This leads to the loss of some opportunities. High TRL level and a strong 10-year financial plan must be in place before a company is started.
- A strategic committee lead by the General Manager of KU, including the leader of the LRD, the Vice rector and the IOF manager makes the investment decisions.
- The Industrial Research Fund (IOF) is a merit based fund from the government of Flanders to the five universities to enhance Tech Transfer. Of €32 mill/year, KU receives 45% (i.e., about €15 mill.):
  - 30% of IOF funding is spent on ~35 permanent positions as "IOF Industrial Research Managers" (also known as "IOF-fellows" or "IOF Innovation managers"). The philosophy of the IRMs is Bridging the gap.
  - The research groups compete for the IRMs (bottom-up. Other universities, e.g., U Gent prioritize scientific fields.)
  - The IRMs/IOF-fellows are followed up closely in terms of coaching, follow-up and career development. In addition to the informal feedback they receive from the PI's, they are evaluated every 3 years (newcomers after 2 years) by a central evaluation committee.
  - Their valorization program (valorization potential, strategy and vision, expertise included) is evaluated by the IOF-council every 5<sup>th</sup> year.

<sup>48</sup> <https://www.reuters.com/article/us-reutersrankings-europeanuniversities/europes-most-innovative-universities-2017-idUSKBN17Z09T>



- Max 10% on patent cost, and max 10% on overhead. Projects for the rest. Allocation advised by broad 35-member The IOF-council

### How to promote innovation?

- ⇒ Metrics is important to promote commercialization. LRD makes annual overview.
- ⇒ The IRMs seem to be a very crucial instrument for KU Leuven. Surprisingly(?), having an IRM in your group increases success in EU-funding

### Conclusions

- ⇒ Excellent research is at the center of the innovation system of KU Leuven.
  - ⇒ An open innovation policy, including two-way interaction, is central to the success of KU Leuven.
  - ⇒ The good support system must be implemented early.
  - ⇒ Support for innovation and commercialization in one responsibility along a continuum
  - ⇒ The innovation support system of KU Leuven is not dependent on individuals.
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## A-4.4 Germany

### A-4.4.1 Technical University of Munich

(<https://www.tum.de/nc/en/>)

*"We invest in talents. Recognition is our return."*

Established in 1868 by King Ludwig II.

Ownership: Public

Key figures (2016/2017)<sup>49</sup>:

- Budget: € 1.451 billion (2017; about NOK 14 billion), 46 % federal contribution (state of Bavaria).
  - 3,249 technical and administrative staff
  - 545 professors, 17% from abroad, 18% women
  - 6,346 scientific staff total
- Structure:
  - Total 15 departments. 4 departments and 4 schools in Munich, further campuses in Garching and Freising. Various centers.
  - 5 focus areas: Energy & Natural Resources; Environment & Climate; Health & Nutrition; Mobility & Infrastructure; Information & Communications
- Education: 40,124 students, 1032 finished PhD-students (2016), 24% international, 34% female
- Research spending: € 357 million (2018)
- Innovation: Commercialization revenues in 2018 € 1.67 million (average 2013-2018: € 2.3 million). Key figures for 2017<sup>50</sup>: 178 inventions, 71 patents, 70 startups

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<sup>49</sup>

[https://www.tum.de/fileadmin/w00bfo/www/TUM\\_in\\_Zahlen/Facts\\_and\\_Figures\\_kurz/Broschuere\\_DatenundFakten\\_2017\\_EN\\_Web.pdf](https://www.tum.de/fileadmin/w00bfo/www/TUM_in_Zahlen/Facts_and_Figures_kurz/Broschuere_DatenundFakten_2017_EN_Web.pdf)

<sup>50</sup> <https://www.tum.de/en/about-tum/our-university/facts-and-figures/>

## Background

TUM is consistently ranked among the top universities in Europe. In the 2019 edition of the QS World University Rankings TUM is ranked 61<sup>st</sup> in the world (16th in Europe). In the ranking of the most innovative universities of Europe (2017), TUM is ranked number four. TUM market themselves as “The Entrepreneurial University”.

The location in Munich in the center of the Bavarian region is important to TUM. As an example, Susanne Klatten, the richest woman in Germany has been associated with TUM for many years, including serving as a long-time Associate and Supervisory Board Chairwoman of UnternehmerTUM GmbH (U-TUM; see below). Her positions in the pharmaceutical and chemical manufacturer Altana and in BMW makes her a very influential person in Bavarian (and German) industry. Klatten contributes with millions of euros each year towards Munich’s start-up ecosystem through her positions at UnternehmerTUM.

The president of TUM, Prof. Dr. Dr. h.c. mult. Wolfgang A. Herrmann was appointed President in 1995. He is the longest-serving President of a German university. He has been instrumental in transforming TUM into “an entrepreneurial university” from the end of the 1990s and thereafter<sup>51</sup>. A separate position as Senior Executive Vice president for Research and Innovation (Prof. Dr. Thomas Hofmann) is leading the innovation work.

## Notes from meeting with Dr. Alexandros Papaderos:

### Innovation system of TU Munich and U-TUM

The internal innovation activities of the Technical University of Munich is organized in the TUM ForTe – Research Funding and Technology Transfer. Important areas of work for the TUM ForTe are:

- Research support: support for fundraising and young scientists.
- Research and Commercial collaboration
- TTO, Patent, Licensing and entrepreneurial activities.

Employees of TUM ForTe are recruited based on strong scientific background, industrial background and/or background from commercialization.

The external innovation and commercialization is organized in U-TUM (UnternehmerTUM). U-TUM comes into play when ForTe wants to push startup teams to progress. In addition to having multiple instruments to develop companies, they also have access to substantial amounts of private capital. U-TUM consists of four separate companies, of which one of them is non-profit. U-TUM is formally independent, but is “attached to TUM” (similar to I of the Imperial College of London). The U-TUM is used to push the spin-out into a format that can make them profitable, including introducing venture capital, as well as many other entrepreneurial activities. The university and the U-TUM, especially related to the academic field of Entrepreneurship, conduct a lot of these activities jointly.

### Organization of commercialization/innovation in the university

- The university inventors receive 30% gross revenue
- Spin-out: Many scenarios: researchers have to file invention disclosures and be active to receive revenue. Inventor’s revenue is also kept when people leave the university. Professors can reduce time in the university and work with the spin-out.
- Professors can also have shares, but need external eyes on the contracts in terms of compliance
- Main scenario: License. Administration is reluctant to own shares.

<sup>51</sup> <https://www.tum.de/en/about-tum/our-university/history/reforms/#c34594>

- External investors usually demand control/ownership of IP
- Only actual inventors in patent applications.

#### **Collaboration with industry**

- Very extensive
- Using the alumni network (with 62,941 members!)<sup>49</sup>
- The location in Munich is one of the explanations of the success of TUM
- Easier when you are a technical university with a lot of applied research.

#### **TUM Culture**

The culture of TUM is positive to innovation and commercialization. When professors are hired, they are looking for industry experience and background. The TUM alumni network is important. Sometimes academics go to a company and return as professors. Strategic relationships are important, joint centers or industry funding buildings.

#### **How to promote innovation?**

- ⇒ Form long-term strategic partnerships with e.g., industry
- ⇒ Parts of the revenue from commercialization is channeled back to the chair of the institute of the innovators.
- ⇒ Culture: Positive to innovation and commercialization

#### **Conclusions: Why does TUM succeed in commercialization?**

- ⇒ The TTO is integrated in the university activities and management structure
- ⇒ Commercialization is supported by the board
- ⇒ Professors with the right mindset are hired
- ⇒ Promotion of the right spirit and commitment (The entrepreneurial university).

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## **A-4.5 Great Britain**

### **A-4.5.1 Imperial College**

(<http://www.imperial.ac.uk/>)

*“Our mission is to achieve enduring excellence in research and education in science, engineering, medicine and business for the benefit of society.”*

In 1907, the Royal College of Science, the Royal School of Mines and the City & Guilds College were combined to form Imperial College London. Public Research University  
Key figures (2016-17):

- Income: £991 million (about 10 billion NOK)
  - 3,770 Academic and research staff, 35% international
- Structure:
  - 4 faculties
  - 6 Institutes across faculties (“Global Institutes”, created to address global challenges)
- Education: 17,566 students, 56% international
- Research income: £361 million
- Licensing revenue: £1.9 million (2017-18; average 2011-2018: £2.2 million<sup>52</sup>).

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<sup>52</sup> <https://www.imperial.ac.uk/enterprise/review/tables-and-figures/>

## **Notes from meeting with Dr. Wadke, Dr. Sarantaridis and Mrs. Kilcoyne**

### **Background<sup>53</sup>**

Imperial is consistently ranked among the top universities in the world. In 2017–18, it is ranked 8th in both the Times Higher Education World University Rankings and QS World University Rankings. Imperial was ranked by Reuters as the most innovative university in Europe in 2015<sup>54</sup>. Staff and alumni include 15 Nobel laureates.

Imperial Innovations: Commercialization is conducted through Imperial Innovations (“II”), which is Imperial’s tech transfer office, and is owned by the IP Group plc<sup>55</sup> (Imperial has a small stake in II).

The relationship with Imperial College London is covered by a 15 year technology pipeline agreement entered in 2005 that grants II exclusive commercialization rights over unencumbered intellectual property developed at the College. In an average year, II assess around 400 inventions disclosed by Imperial staff, complete 30-40 license deals, form 8 new companies and file patents on 60 new technologies. In addition to working with Imperial College London, II provide technology transfer services to select NHS Trusts in London linked with the College.

### **Innovation system of Imperial College London**

- Imperial College follows a dual leadership model (President and Provost), similar to US Universities.
- Professor Alice P. Gast is the President, with a background from MIT emphasizing innovation/entrepreneurial attitude. She is the ‘face’ of Imperial promoting outward activities and engagement.
- Professor Ian Walmsley is the Provost) has the “responsibility for delivering and enhancing Imperial’s core academic mission – the pursuit of excellence in education, research and translation. This allows the President to give more emphasis to strategic issues and the College's development.”
- There are two vice-Provosts, one for Education and one for Research and Enterprise (Professor Nick Jennings).
- The Enterprise activities/functions consist of e.g., Corporate Partnerships, Academic and Technology Ventures, Corporate Engagement, Programme Management Office, Imperial Business Partners, Imperial Tech Foresight, Enterprising Students, Venture Mentoring Service and Techcelerat <sup>56</sup>.

### **Organization of commercialization/innovation**

- IP commercialization is conducted through Imperial Innovations (“II”), which is independent of Imperial College London.
- II has a 15 year technology pipeline agreement that grants II exclusive commercialization “first rights”.
- The College has its internal support system for commercialization in “Enterprise – Imperial’s dedicated department for industry interactions and business ventures.” Enterprise reports to the vice-Provost for Research and Enterprise.

### **Organization of the Innovation and commercialization pipeline**

- Corporate partnerships:

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<sup>53</sup> [https://en.wikipedia.org/wiki/Imperial\\_College\\_London](https://en.wikipedia.org/wiki/Imperial_College_London)

<sup>54</sup> <https://www.reuters.com/article/idUSL1N11K16Q20150915>

<sup>55</sup> <https://www.imperialinnovations.co.uk/>

<sup>56</sup> <http://www.imperial.ac.uk/enterprise>

- High research funding from industry (18% - £61 million): Oil&Gas largest, followed by Pharma and Engineering/Power
- Industry-funded Centers. Size from £2.5 million over 5 years and up. Shell is the largest partner. Rolls Royce is another large partner.
- Imperial Business Partners
- Academic and Technology Ventures:
  - An elaborate system of support for both academic staff and students.
  - Imperial White City incubator: New campus in west London. Including a large incubator (I-Hub)
- Mobilizing students to entrepreneurial activities.

### **How to promote innovation from Imperial College**

- ⇒ Strong support from leadership
- ⇒ Key: training early stage researchers. Seniors might not have the time. Do not want to pressure academics into commercialization.
- ⇒ Founders Choice: Provides an opportunity for staff to form a spin-out without being diluted
- ⇒ The Research Excellence Framework (REF): Contains metrics for impact.
- ⇒ Challenge: How to find the researchers with ideas, results and willingness to commercialize. Long discussions and concentrated effort on potential researchers.

### **Conclusions: Why success for Imperial College**

- ⇒ Imperial College London has a long history of collaboration between academia and the real world.
  - ⇒ Strong professionalism
  - ⇒ Striving for excellence
  - ⇒ Strong entrepreneurial culture
  - ⇒ Profile of Imperial suited for commercialization (no humanities)
  - ⇒ Tech Transfer should not be seen as money making
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## **A-4.6 Italy**

### **A-4.6.1 Politecnico di Milano**

(Polytechnic University of Milan)

(<https://www.polimi.it/en>)

*“The Entrepreneurial University”*

Established in 1863

Ownership: Federal government

Key figures<sup>57</sup>:

- Employees
  - 1,403 scientific staff total
- Structure:
  - 7 campuses, with majority of activities in the two Milan campuses
  - 12 departments

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<sup>57</sup> [https://en.wikipedia.org/wiki/Polytechnic\\_University\\_of\\_Milan](https://en.wikipedia.org/wiki/Polytechnic_University_of_Milan) and <https://www.polimi.it/en/the-politecnico/about-polimi/politecnico-di-milano-figures/>

- 3 focus areas in Milan: Engineering, Architecture and Design
- Education: 42,453 students (2018/19) – 75% in engineering, about 1100 PhD-students. 14% international
- Innovation: € 6.4 million income from licenses etc. since 2000; about 1600 running patents (IT and manufacturing largest); about 200 invention disclosures every year; about 60 spin-offs since 2000 (3 new in 2017); 8 major exits.

### **Background**

Politecnico di Milano (Polimi) is the highest ranked Italian university, although the Italian universities are not very highly ranked (e.g., Polimi is ranked 156<sup>th</sup> in the 2019 edition of the QS World University Rankings<sup>58</sup>; 65<sup>th</sup> among European universities). However, Polimi is quite competitive within subject areas like Architecture, Art & Design and various Engineering subjects.

The innovation ecosystem around the Polimi has been build up over time from the early 2000's.

### **Notes from meeting with Dr. Beatrice Saglio and Mr. Mauro Croce**

#### **Innovation ecosystem of Polimi**

The mission of technology transfer is realized through:

- The Technology Transfer Office, which is part of the Polimi (internal)
- Polihub, which is the innovation district and startup accelerator of Politecnico di Milano, managed by Fondazione Politecnico di Milanov. Polyhub is a ltd, owned by among others Polimi (external).

#### **Organization of commercialization/innovation in Polimi**

The TTO is the operational unit for commercialization at Polimi. The head of the Office reports to the General Director of the Polimi.

Pros and cons of being part of the university:

- Communication with the scientific staff is easy
- Well known administrative routines
- Policy matters can be dealt with more easily
- No intermediaries between the university and the innovators
- Payments to external partners can be slow and difficult
- Some negativity from the senior scientific staff, but a change in mentality

The rector (Professor Ferruccio Resta) is personally focused on innovation.

#### **TTO work with commercialization pipeline**

- TTO try to find companies that can utilize the research conducted at Polimi
- Conducting technology transfer activities in collaboration with Polihub, while the technology transfer fund “Poli360” provides early stage funding.
- In ICT patenting is normally not the strategy
- Polimi does not allow professors and scientists to have managing roles in their spin-offs.

<sup>58</sup> <https://www.topuniversities.com/university-rankings/world-university-rankings/2019>



### **Organization of commercialization/innovation in Polihub**

Polihub is an independent limited company, but is owned by Politecnico di Milano and three other companies (which are also controlled by Polimi). Polihub have been ranked as the 2.nd best university incubator in Europe, and number 3 internationally.

Polihub has three missions:

- Scout new ideas (“startup”)
- Attract ideas/startups from the outside (“Scale-up”)
- Create an innovation ecosystem (“District”)

Polihub sees themselves as recipients of ideas from both the university and from the outside innovation system. They help to “open the doors” to the university for companies.

Furthermore, they are also managing a large network of industrial and executive mentors.

Polihub provides co-working space. Polihub monitors all companies in the accelerator closely (interviews bimonthly). The accelerator activities are conducted in close collaboration with the Business school of Polimi (which is also an owner) and industry partners.

The startup service offered by Polihub is organized in three “layers”:

- A standard commercialization toolkit: mentoring, counselling
- A customized scale-up toolkit: Acceleration program, 4-6 months for startups from Polihub (idea stage, together with the business school), Mentor’s club (startup phase, around 80 people), Advisory program that connects companies with externals (scale-up phase)
- A tailored toolkit: Assist in gaining access to funding at all stages (idea, startup, scale-up)

### **How to promote innovation?**

- ⇒ Various measures, e.g., “Switch to product”<sup>59</sup> (a competition for ideas – the five best gets €30 000 to develop their idea)
- ⇒ Incentives: Inventors gets to keep as much as 60% and 12% is allocated to the department of the inventor

### **Conclusions: Why does Polimi succeed in commercialization?**

- ⇒ A public university that is managed in a private like way
- ⇒ Attitude by the management to make a different university over time

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<sup>59</sup> <https://s2p.it/>

## A-4.7 Norway

### A-4.7.1 University of Oslo (UiO)

(<https://www.uio.no/english/>)

*“One of Europe’s most innovative universities”<sup>60</sup>*

Established in 1811

Ownership: Federal government

Key figures (2018)<sup>61</sup>:

- Budget: NOK 8.0 billion (about € 800 million).
  - 6,607 total staff
  - 3,814 academic staff total (FTE)
  - 1,119 support staff (FTE)
- Structure:
  - 8 faculties and two museums
  - Part of The Guild
- Education: 27,915 students, 493 PhD-candidates finished. 15% international students
- Innovation results: Annual income (2018): About €25.000 from licenses etc. A sale of a company for about €450.000.
- Innovation results from Invent2 in 2018<sup>62</sup>: 104 patent applications and 179 invention disclosures. 5 spin-offs in 2018. 26 new license agreements in 2018.

**Notes from meeting with Professor Sandset, Professor Skoie, Professor Bergersen, Professor Brennen, Professor Andersen, Professor Falck, Professor Gørbitz, Dr. Bakken, Professor Gulbrandsen, Dr. Skorge, Mrs. Alm, Mr. Bergland**

#### Background

UiO is ranked 62<sup>nd</sup> among the top universities in the world and 22<sup>nd</sup> in Europe (Shanghai Ranking of World Universities). As of 2018, 5 Nobel Prize winners have been affiliated with the University.

The University Board, consisting of 11 members and chaired by the Rector, is the University’s highest body. Four of the members are appointed by the government. The Rector of the University of Oslo (UiO) is elected (for the period 2017-2021). The Rector has ultimate responsibility for the academic activities at the University of Oslo (UiO) and is Chair of the University Board. He is also the institution's legal representative and spokesperson in dealings with the general public and government authorities. The Rector is joined by one pro-rector and two vice-rectors.

The faculties of UiO have been quite independent through recent history.

#### Innovation system of UiO

1. *Research Base*: Basic research is the foundation for innovation at UiO. In general, the commercialization of UiO has centered on life science research, with clinical studies an important part.
2. *Inven2*: All commercialization of UiO and Oslo University Hospital (OUS) is done through the limited company Inven2. Inven2 is jointly owned by the university and the university hospital.

<sup>60</sup> <https://www.uio.no/english/about/strategy/highlights/uio-highlights-eng-2018-09.pdf>

<sup>61</sup> <https://www.uio.no/english/about/facts/figures/>

<sup>62</sup> Jointly with the Oslo University Hospital; <https://www.inven2.com/annual/2018/>

3. *Internal support:* Innovation and commercialization activities are not supported through any separate unit in the central university management, but are part of the Research Administration (Research Support and Research Management Office).

### **Organization of commercialization/innovation**

The University of Oslo (UiO) has not previously had any one person in the leadership responsible for innovation. Now, one of the vice-rectors, Per Morten Sandset, is responsible for innovation. The Technology Transfer Office (TTO) *Inven2* is responsible for all commercialization from UiO and the University Hospital (OUS). Inven2 is a limited company jointly owned by UiO and OUS. Thus, there is no direct managerial line between UiO and Inven2. All management is to be conducted through the board of Inven2. In a sense, the commercialization work is “outsourced”. UiO spends about NOK 11 million (€ 1.1 million) per year to support the activities in Inven2. The university will evaluate its management of Inven2.

Other kinds of innovation work are run by UiO, e.g., entrepreneurial activities such as “Insj” and Spark. Many of the activities are conducted in collaboration with Inven2. There are educational programs within entrepreneurship at several faculties.

Traditionally, the commercialization activities of Inven2 (and its predecessors, e.g., Birkeland Innovasjon) have been targeted towards research from the life science field (e.g., humane medicine and biomedicine). The university leadership does not have particular goals for commercialization, but wants it to increase.

### **Organization of the TTO/commercialization pipeline**

- Innovation and commercialization is supported by the Research Administration (Research Support and Research Management Office).
- Revenue from commercialization is distributed as follows (subject to any financial claims by a third party):
  - 1/3 to the inventor(s)
  - 1/3 to the faculty (at least 8% is channeled to the institute or the research group)
  - 1/3 to Inven2
- Entrepreneurship: Many activities in Inven2. UiO is a member of SPARK international.
- Young entrepreneurs: Collaboration with external interests, e.g., Bayer collaborates with UiO to build a “biomakerspace” in the new life science building.
- Support for technology transfer: the support of researchers is done in Inven2.

### **How to promote innovation?**

- ⇒ Work on an innovation strategy/action plan for the entire university. The innovations initiative (“Innvasjonsløftet”) has been discussed at all parts of the university
- ⇒ Oslo Science City: An initiative from the Oslo municipality inspired by White City of London: A “corridor” of innovative organizations and institutions from Oslo University Hospital towards downtown.
- ⇒ Funding of verification support (€ 0.9 million)
- ⇒ No special targeted incentives for researchers

### **Conclusions: Why does UiO succeed in commercialization?**

- ⇒ UiO has strong basic research, especially within life sciences, as a basis for innovation.

