Summary report of the knowledge transfer survey 2013-2014

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Executive Summary

This report provides some of the highlights of a survey conducted during the fall of 2014, on the knowledge transfer activities of public research organisations (PROs) in 2012 and 2013. In total, 128 knowledge transfer offices (KTOs) were surveyed. With 97 replies, to both the ASTP-Proton and the UNU-MERIT survey, the response rate was 75.8%.

The main objective of this study is to compare the activities of commercialising public funded research in Norway to five "barometer" countries which include, Austria, Denmark, Finland, Netherlands and Sweden. The results of this analysis have been included in the Norwegian Research Barometer 2015[1].

Most of the PROs in the sample represent universities, were established after 2005, and have less than 5 office staff employees. Furthermore most of the KTO staff have at least one staff member with a university qualification in the biomedical field and in management or business studies. Most of the KTO staff draw upon external expertise for drafting patent applications and preparing contracts, such as license and research agreements.

Biomedical intellectual property is the largest generator of license revenue, accounting for 83.3% of the total reported license revenue for 2013, followed by ICT at 11.2% and by 'other subject areas' (5.4%). This suggests that the presence of a strong health, biotechnology or medical faculty at a university or research institute is likely to be a major factor in earning license revenue.

Almost two-thirds of universities and other research organisations report that their licensed technology resulted in at least one commercially successful product or process in the previous three years.

Standardised performance measures for 2013 per 1,000 research personnel have shown that Danish PROs outperform other PROs in the barometer countries on patent applications, license agreements and license income. Swedish PROs perform best in terms of patent grants and start-ups, and Finnish PROs lead in terms of invention disclosures. This is the same for universities only except that Swedish universities also lead in terms on invention disclosures.

Standardised performance measures for the panel data set per 1,000 research personnel have shown that public research organisations in across all barometer countries are performing better over time for most indicators. Danish PROs have however seen a substantial increase in their performance in terms of license agreements and license income. The same holds for Austria, although to a lesser extent.

[1] https://www.regjeringen.no/nb/tema/forskning/innsiktsartikler/forskningsbarometeret/forskningsbarometeret-pdf/id2409807/

1. Introduction

Almost all R&D in the public sector is conducted either by government research institutes or by universities, such as general universities, technical universities, academic hospitals, government or non-profit other research organisations, or research parks or incubators affiliated with these public organisations. Together, these are defined in this report as public sector research organisations, or PROs. Although a significant share of the R&D performed by PROs is either basic research or humanities research with few short-term commercial applications, a substantial (although unknown) share of public research has immediate or potential commercial value. This includes research of value to a wide range of commercial applications, including, health applications, aerospace computerization, energy, and new materials.

In order to encourage and support knowledge transfer activities, particularly those that require legal and technical expertise, many European PROs have established Knowledge Transfer Offices (KTOs) that can provide professional advice to assess the patentability of inventions, interact with firms, and provide licensing expertise. Not all designated offices are named a knowledge transfer office. Technology transfer office is also often used next to innovation office, valorization office and research affairs. For easy of understanding all these types of offices involved in knowledge transfer activities that serve a PRO are named KTOs in this report.

Although some PROs have had KTOs for decades, the majority of European KTOs have been established since 1990. In the study reported here, 84.9% of KTOs were established after 2000 and 54.8% after 2005. These KTOs collect data that can be used to construct indicators for the knowledge transfer activities of the PROs that they serve. This information is of value not only for the KTOs themselves, but also for policy to support knowledge transfer. Both groups can use this information to benchmark knowledge transfer activities and to track progress, for instance in response to KTO actions to improve the efficiency of their staff or policy actions to encourage knowledge transfer.

This report provides some of the highlights of a survey conducted during the fall of 2014, on the knowledge transfer activities of public research organisations in 2012 and 2013. Public research organisations include universities and government-funded other research organisations (the latter are henceforth referred to as ('other research organisations'). The survey was conducted as part of a project funded by the Norwegian Ministry of Education and Research.

The main objective is to compare the activities of commercialising public funded research in Norway to five "barometer" countries which include, Austria, Denmark, Finland, Netherlands and Sweden (all these countries are henceforth referred to as 'barometer countries'). The results of this analysis have been included in the Norwegian Research Barometer 2015.

Section 2 provides the results for up to 94 organisations across the barometer countries. The survey collected data on the characteristics of knowledge transfer offices and on nine outcome measures.

2. Survey on knowledge transfer activities 2012-2013

2.1 Introduction and Methodology

In the fall of 2014, UNU-MERIT surveyed the KTOs of the six barometer countries in order to obtain information on their knowledge transfer activities in 2012 and 2013. The survey targeted the managers of KTOs across the six barometer countries.

During the process of collecting data on knowledge transfer activities in these countries a collaboration agreement was established between UNU-MERIT and ASTP-Proton in September 2014. ASTP-Proton is the premier, pan-European association for professionals involved in knowledge transfer between universities and industry. The reasons to collaborate with ASTP-Proton was to reduce the response burden of KTOs making them more inclined to reply next to the fact that ASTP-Proton has a large membership of people working at KTOs.

ASTP-Proton collects annually data on the knowledge transfer activities of their members. Their survey started on August 7, and closed on October 31. UNU-MERIT was responsible for contacting PROs in the Netherlands to reply to the ASTP-Proton survey. In return ASTP-Proton would share the collected data from 2012 and 2013 on the knowledge transfer activities of PROs 2013 in Norway and the five "barometer" countries.

In total, 128 knowledge transfer offices were surveyed, ranging from 13 in Denmark to 25 Austria. With 97 replies, to both the ASTP-Proton and the UNU-MERIT survey, the response rate was 75.8%. Not all responses, however, were eligible: 9 respondents reported no knowledge transfer activities. This left 88 valid responses for analysis. Results for an additional 3 public research organisations were obtained for Denmark from the Danish Agency for Science, Technology and Innovation (DASTI), and 3 for Norway from the Norwegian research council and from the Nordic Institute for Studies in Innovation, Research and Education (NIFU). Table 1 gives an overview of the sample size, responses and valid responses across the six barometer countries.

Table 1. Responses by country

Country	Sample	Responses	Response rate	Valid responses
Austria	25	20	80.0%	15
Denmark	13	11	84.6%	11
Finland	23	16	69.6%	13
Netherlands	18	13	72.2%	13
Norway	20	17	85.0%	17
Sweden	29	20	69.0%	19
Total	**128**	**97**	**75.8%**	**88**

Source: UNU-MERIT.

The next sections provide some of the main results on the characteristics of the responding knowledge transfer offices and on the knowledge transfer performance of their affiliated public research organisations. Results are provided for six key and three supplementary knowledge transfer activities in 2012 and 2013. The six key indicators are collected in most national surveys, including the AUTM survey for the United States and Canada. They include three measures of activities that do not necessarily result in knowledge transfer: the number of invention disclosures, the number of priority patent applications, and the number of technically-unique patent grants.[2] The second set of key indicators consists of measures that involve knowledge transfer to firms: the number of start-ups[3], the number of licenses or option agreements with companies, and the amount of license income earned.

The three supplementary indicators are not collected in many national surveys. They include the number of R&D agreements between the affiliated institution and companies, the number of USPTO patent grants, and the number of successful start ups (the start up developed a product/process that is in use or sold on the market since 2008). In addition, the survey collected data on the types of licensees and license revenue by research area.

[2] The limitation to technically unique patents prevents double counting of the same invention in more than one jurisdiction.

[3] A start-up is defined in the questionnaire as a company **specifically** established to exploit technology or know-how created by your institution.

2.2 Characteristics of European Knowledge Transfer Offices

Most of the 94 Knowledge Transfer Offices (KTOs) represent universities, were established after 2005, and have less than 5 office staff employees.

- 36.2% of the KTOs represent general universities, 21.3% universities with a hospital, 23.4% technical universities and 19.1% represent other research organisations, see Table 2.
- 5.5% of KTOs were established before 1990, 9.6% between 1990 and 1999, 30.1% between 2000 and 2005 and 54.8% after 2005, see Table 3.
- 27.8% of the KTOs have two or fewer staff, while 26.6% have 10 or more staff.
- The average date of establishment is 2004 for KTOs representing universities and 2001 for KTOs representing other research organisations, see Table 4.
- 57.1% of KTOs have at least one staff member with a university qualification in the biomedical field and 54.3% of KTOs have at least one staff member with a university qualification in management or business studies, see Table 5.
- 85.5% of KTOs use external experts for drafting patent applications and other legal matters. Next to this, KTOs frequently ask external expertise for preparing contracts (63.8%), see Table 6.

Table 2. Type of public research organisation

	Number	Percentage
General universities	34	36.2%
Technical universities	20	21.3%
Universities with a hospital	22	23.4%
Other research organisations	18	19.1%
Total	**94**	**100.0%**

Source: UNU-MERIT.

Table 3. Distribution of the year of establishment of the KTO, 2012-2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
before 1990	3	4.8%	0	0.0%	1	6.3%	1	10.0%	4	5.5%
1990 - 1999	5	7.9%	1	5.3%	1	6.3%	2	20.0%	7	9.6%
2000 - 2005	20	31.7%	8	42.1%	6	37.5%	2	20.0%	22	30.1%
after 2005	35	55.6%	10	52.6%	8	50.0%	5	50.0%	40	54.8%
Total	**63**	**100.0%**	**19**	**100.0%**	**16**	**100.0%**	**10**	**100.0%**	**73**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

Table 4. Distribution of the number of office staff (FTE), 2012-2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
Up to 2	18	27.7%	4	19.0%	2	11.8%	4	28.6%	22	27.8%
2 – 5	16	24.6%	4	19.0%	3	17.6%	3	21.4%	19	24.1%
5 – 10	13	20.0%	5	23.8%	6	35.3%	4	28.6%	17	21.5%
10 or more	18	27.7%	8	38.1%	6	35.3%	3	21.4%	21	26.6%
Total	**65**	**100.0%**	**21**	**100.0%**	**17**	**100.0%**	**14**	**100.0%**	**79**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

Table 5. University qualifications of KT office employees, 2012-2013

	Number	Percentage
Engineering or natural sciences	34	48.6%
Biomedical	40	57.1%
Law	39	55.7%
Finance	20	28.6%
Management or business administration	38	54.3%
None of the above	22	31.4%
Valid responses	**70**	

Source: UNU-MERIT. Note: Valid responses are the number of respondents that answered this question.

Table 6. KTO use of external expertise, 2012-2013

	Number	Percentage
Evaluating the commercial potential of invention disclosures	26	37.7%
Patent applications and other legal matters involving intellectual property rights	59	85.5%
Preparing contracts for research agreements, licensing, etc.	44	63.8%
Marketing or advertising your intellectual property	26	37.7%
None of the above	10	14.5%
Valid responses	**69**	

Source: UNU-MERIT. Note: Valid responses are the number of respondents that answered this question.

At most public research organisations the ownership of intellectual property is held by the institution itself exclusively (34.1%) or shared between the institution and other parties (38.5%).

Table 7. KTO use of external expertise, 2012-2013

	First right to IP in combination with other parties				
Type of PRO	**The institution**	**Companies**	**The inventor**	**Other**	**Valid responses**
Universities	39.7%	22.4%	29.3%	8.6%	68
Universities with hospital	56.7%	20.0%	23.3%	0.0%	19
Technical universities	40.7%	18.5%	29.6%	11.1%	18
Other research organisations	33.3%	29.6%	18.5%	18.5%	14
Total	**38.5%**	**23.8%**	**27.3%**	**10.5%**	**82**
	Exclusive first right to IP				
Type of PRO	**The institution**	**Companies**	**The inventor**	**Other**	**Valid responses**
Universities	35.3%	2.9%	11.8%	2.9%	68
Universities with hospital	57.9%	0.0%	0.0%	0.0%	19
Technical universities	38.9%	0.0%	16.7%	0.0%	18
Other research organisations	28.6%	7.1%	0.0%	0.0%	14
Total (exclusively)	**34.1%**	**3.7%**	**9.8%**	**2.4%**	**82**
	First right to IP in combination with other parties				
Country	**The institution**	**Companies**	**The inventor**	**Other**	**Valid responses**
Austria	68.4%	26.3%	5.3%	0.0%	14
Denmark	90.0%	10.0%	0.0%	0.0%	9
Finland	37.5%	34.4%	28.1%	0.0%	12
Netherlands	68.4%	10.5%	21.1%	0.0%	13
Norway	21.2%	39.4%	24.2%	15.2%	16
Sweden	0.0%	7.4%	59.3%	33.3%	18
	Exclusive first right to IP				
Type of PRO	**The institution**	**Companies**	**The inventor**	**Other**	**Valid responses**
Austria	57.1%	0.0%	0.0%	0.0%	14
Denmark	88.9%	0.0%	0.0%	0.0%	9
Finland	8.3%	0.0%	0.0%	0.0%	12
Netherlands	69.2%	0.0%	0.0%	0.0%	13
Norway	12.5%	18.8%	0.0%	0.0%	16
Sweden	0.0%	0.0%	44.4%	11.1%	18

Source: UNU-MERIT. Note: Valid responses are the number of respondents that answered this question.

2.2.1 Characteristics of the PRO, research personnel

The total number of research personnel covered in 2013 is 135,620 full-time equivalents (FTEs). Out of this total, 127,348 researchers are working at universities, of which 39,723 FTE at universities with a hospital and 34,749 at technical universities. Out of the 135,620 researches in total for 2013, 8,271 researchers are working at other research organisations. Table 8 below shows the distribution of research personnel among 84 PROs in 2013. Average research personnel at universities is 1,873 FTE, 2,207 at universities with a hospital, 1,931 at technical universities and 517 FTE at other research organisations.

Table 8. Distribution of research personnel, 2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
up to 499	14	20.6%	2	11.1%	1	5.6%	10	62.5%	24	28.6%
500-1249	16	23.5%	2	11.1%	7	38.9%	5	31.3%	21	25.0%
1250-2499	20	29.4%	8	44.4%	6	33.3%	1	6.3%	21	25.0%
2500 or more	18	26.5%	6	33.3%	4	22.2%	0	0.0%	18	21.4%
Total	**68**	**100.0%**	**18**	**100.0%**	**18**	**100.0%**	**16**	**100.0%**	**84**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

2.2.2 Characteristics of the PRO, research expenditures

Data on research expenditures are only available for 53 public research organizations. The total reported research expenditures amounted to approximately €6.9 billion, of which €6.3 billion was spent by universities and €0.5 billion by other research organisations. Average research expenditures were €140 million at universities and €67 million at other research organisations. Table 9 gives the distribution of research expenditures.

Table 9. Distribution of research expenditures, 2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
up to 10m	5	11.1%	1	10.0%	0	0.0%	1	12.5%	6	11.3%
10m - 50m	15	33.3%	2	20.0%	3	25.0%	4	50.0%	19	35.8%
50m - 150m	8	17.8%	1	10.0%	3	25.0%	2	25.0%	10	18.9%
150m or more	17	37.8%	6	60.0%	6	50.0%	1	12.5%	18	34.0%
Total	**45**	**100.0%**	**10**	**100.0%**	**12**	**100.0%**	**8**	**100.0%**	**53**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

2.3 Results for Knowledge Transfer Activities

Tables 10 and 11 summarize the results for the six key and three supplementary knowledge transfer indicators in 2013. The mean number of each type of outcome is not a performance measure, since the mean will vary depending on the number of researchers or research expenditures at each public research organisation. Standardised performance measures accounting for size differences are given in Section 2.4.

A small percentage of universities and other research organisations account for a large share of each outcome. This is partly due to a significant share of organisations reporting zero outcomes. The least common output is USPTO patent grants, with 64.5% of universities and 71.4% of other research organisations reporting no USPTO patents. The second least common output is successful start-ups, with none reported by 43.6% of universities and 50.0% of other research organisations.

The second cause is due to the concentration of outcomes in a small number of universities and other research organisations. The last column in Table 10 and Table 11 gives the percentage of the total number of outcomes that are reported by the top 10% of the universities and other research organisations. For example, 63 universities report a total of 2,838 patent grants in 2013. The top 10 % performing universities account for almost half of these invention disclosures, 47.6% of the total.

Table 10. Summary of key and supplementary indicators for universities, 2013

	Valid responses[1]	Mean	Total reported	Percent zero[2]	Percent by top 10%[3]
Invention disclosures	63	45.0	2,838	12.7%	47.6%
Patent applications	64	10.5	669	17.2%	43.0%
Patent grants	47	3.5	165	42.6%	43.6%
USPTO patent grants	31	0.8	26	64.5%	57.7%
Start-ups established	61	4.4	270	34.4%	52.2%
Successful start-ups	39	4.3	166	43.6%	47.6%
Licenses executed	55	7.0	385	41.8%	51.2%
License income (€)	45	318,025	14,311,107	42.2%	53.5%
R&D agreements	38	132.1	5,018	7.9%	49.5%

Source: MERIT. Notes: (1) Number of KTOs reporting results for each performance measure (including zero outcomes).
(2) Percent of respondents reporting 'zero' for each outcome. For example, 12.7% of 63 universities reported zero invention disclosures in 2013. (3) Percent of the total reported by the top 10% of the respondents. For example, 6 universities (10% of 63 reporting results) accounted for 47.6% of the 2,838 invention disclosures reported by universities.

Table 11. Summary of key and supplementary indicators for other research organisations, 2013

	Valid responses[1]	Mean	Total reported	Percent zero[2]	Percent by top 10%[3]
Invention disclosures	11	38.0	418	18.2%	69.6%
Patent applications	14	9.8	137	28.6%	82.5%
Patent grants	14	4.9	69	28.6%	81.2%
USPTO patent grants	7	0.4	3	71.4%	0.0%
Start-ups established	15	3.5	53	40.0%	75.5%
Successful start-ups	8	2.1	17	50.0%	0.0%
Licenses executed	11	9.3	102	45.5%	89.2%
License income (€)	15	1,713,525	25,702,882	26.7%	95.2%
R&D agreements	5	147.4	737	0.0%	81.4%

Source: MERIT. Notes: (1) Number of KTOs reporting results for each performance measure (including zero outcomes). (2) Percent of respondents reporting 'zero' for each outcome. For example, 18.2% of 11 other research organisations reported zero invention disclosures in 2013. (3) Percent of the total reported by the top 10% of the respondents. For example, 1 research institute (10% of 11 reporting results) accounted for 69.6% of the 418 invention disclosures reported by other research organisations, which is off course an outlier.

2.3.1 Licensing

The total number of reported license agreements covered in 2013 are 487 across the six barometer countries. Out of this total, 385 were reported by universities, of 215 at universities with a hospital and 116 at technical universities. Out of the 487 license agreements reported in total for 2013, 102 were reported by other research organisations. Table 12 below shows the distribution of license agreements among 66 PROs in 2013. Average license agreements at universities are seven, 13 at universities with a hospital, 9 at technical universities and nine at other research organisations. The results in Table 12 show that 42.4%, or 28 out of 66, had zero license agreements in 2013.

Table 12. Distribution of license agreements by type of PRO, 2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
Zero	23	41.8%	2	11.8%	4	30.8%	5	45.5%	28	42.4%
1 - 4	12	21.8%	4	23.5%	4	30.8%	3	27.3%	15	22.7%
5 - 9	7	12.7%	4	23.5%	1	7.7%	1	9.1%	8	12.1%
10 or more	13	23.6%	7	41.2%	4	30.8%	2	18.2%	15	22.7%
Total	**55**	**100.0%**	**17**	**100.0%**	**13**	**100.0%**	**11**	**100.0%**	**66**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

Total license income as reported by 60 PROs across the six barometer countries for 2013 amounted to €40 million. Out of the total, approximately €14.3 million was earned by

universities and approximately €25.7 million by other research organisations. Average license income was €318,025 at universities, €695,627 at universities with a hospital, €301,342 at technical universities and €1,713,525 million at other research organisations. Table 13 below shows the distribution of license income for 60 PROs.

As shown in Table 13, the distribution of license income is highly skewed. For all universities, 42.2% reported zero license income and 62.2% in total reported less than €50,000 license income. Other research organisations perform better. They gain more license income on average and fewer reported zero license income, 26.7%.

Table 13. Distribution of license income by type of PRO, 2013

	Universities		Universities with hospital		Technical universities		Other research organisations		Total sample	
	#	%	#	%	#	%	#	%	#	%
Zero	19	42.2%	2	11.8%	3	42.9%	4	26.7%	23	38.3%
0 - 19,999	4	8.9%	3	17.6%	0	0.0%	0	0.0%	4	6.7%
20,000 - 49,999	5	11.1%	1	5.9%	1	14.3%	3	20.0%	8	13.3%
50,000 - 149,999	6	13.3%	3	17.6%	0	0.0%	1	6.7%	7	11.7%
150,000 - 249,999	1	2.2%	1	5.9%	0	0.0%	0	0.0%	1	1.7%
250,000 - 499,999	4	8.9%	2	11.8%	2	28.6%	3	20.0%	7	11.7%
500,000 - 1,999,999	4	8.9%	3	17.6%	1	14.3%	1	6.7%	5	8.3%
2 million or more	2	4.4%	2	11.8%	0	0.0%	3	20.0%	5	8.3%
Total	**45**	**100.0%**	**17**	**100.0%**	**7**	**100.0%**	**15**	**100.0%**	**60**	**100.0%**

Source: UNU-MERIT. #; number, %; percentage.

Share of license revenue by research field

Respondents were asked if their affiliated institution applied for at least one patent from each of five research fields. This provides an indicator for the production of knowledge with a *potential* to earn license revenue. License revenue can also be earned without a patent, for instance through assigning know-how, copyright, or other forms of intellectual property, but at least one patent application in a research field suggests the production of commercially valuable inventions in this research area. Second, respondents were asked to estimate the distribution of license revenue by research field.

Table 14 gives the percent of public research organisations that report at least one patent application from each of five research fields. Out of the 51 public research organisations which answered this question, 76.5% had at least one patent application in the biomedical subject area. The biomedical subject area is therefore the most common subject area for patent applications at both universities (78.0%) as well as other research organisations (70.0%). The second most frequent research area (ignoring the 'other' category) is the

nanotechnology field (37.3%). Low or zero carbon energy technology was the least common subject area reported, with only 21.6% of all public research organisations reporting at least one patent application in this field.

Table 14. Share of public research organisations applying for at least one patent by research area, 2012-2013

	Universities	Universities with hospital	Technical universities	Other research organisations	Total sample
Biomedical	78.0%	100.0%	76.9%	70.0%	76.5%
ICT: Computers, communication equipment and software	39.0%	40.0%	46.2%	50.0%	41.2%
Nanotechnology and new materials	41.5%	30.0%	53.8%	20.0%	37.3%
Low or zero carbon energy technologies	22.0%	10.0%	53.8%	20.0%	21.6%
Other subject areas not listed above	48.8%	20.0%	53.8%	30.0%	45.1%
Valid responses	**41**	**10**	**13**	**10**	**51**

Source: UNU-MERIT. Note: Valid responses are the number of respondents that answered this question.

The distribution of patent application activity by research field, as shown in Table 14, does not translate into similar license income by subject area. As shown in Table 15, licenses for biomedical knowledge account for a large majority of license income: 73.1% of income reported by universities and 84.0% of income reported by other research organisations. The dominance of the biomedical field suggests that public research organisations without health, biotechnology, or pharmaceutical research are likely to earn significantly less license income than those that conduct research in these fields.

Table 15. Licence income by research area, 2013

	Universities	Other research organisations	Total
Biomedical	73.1%	84.0%	83.3%
Computers, communication equipment and software (ICT)	12.3%	11.2%	11.2%
Nanotechnology and new materials	0.6%	0.0%	0.0%
Low/zero carbon energy technologies	0.0%	0.0%	0.0%
Other subject areas not listed above	13.9%	4.8%	5.4%
Total	**100.0%**	**100.0%**	**100.0%**

Source: UNU-MERIT.

Commercially profitable outcomes of licensing

More than half (61.5%) of respondents that answered this question reported that licensed technology or knowledge had resulted in at least one commercially profitable product or process in the previous three years. There is some difference by the type of public research organisation, with successful outcomes reported for 92.3% of technical universities and 77.8% of other research organisations.

Table 16. Successfulness of PROs licensed technology in the last three years, by type of PRO, 2012 - 2013

	Commercially profitable products or processes				
	Valid responses	Yes		No or DK	
		#	%	#	%
Universities	51	30	58.8%	21	41.2%
Universities with hospital	12	8	66.7%	4	33.3%
Technical universities	15	14	93.3%	1	6.7%
Other research organisations	9	7	77.8%	2	22.2%
Total	**60**	**37**	**61.7%**	**23**	**38.3%**

Source: UNU-MERIT. #; number, %; percentage. Note: Valid responses are the number of respondents that answered this question.

2.4 Standardised performance Indicators

On average, large public research organisations have more research staff and funding and therefore produce more knowledge outputs and earn more license revenue than small public research organisations. In order to compare results across countries or over time it is necessary to control for the size effect by producing standardised indicators. Two methods are available for this: standardization per 1,000 research staff and standardization per unit of research expenditure. The research expenditure data can be adjusted for purchasing power parities (PPP) in different countries.

However, for comparisons across the six barometer countries, the indicators based on research staff are preferable because a higher number of respondents were able to provide data on research staff than on research expenditures. Another reason why the number of research staff is preferable is due to different cost structures for research across countries. Although the research expenditures are adjusted for purchasing power parity (PPP), the PPP estimates are not limited to research expenditures but cover a wide basket of goods and services in each country. Consequently, this report provides standardised performance indicators by research staff. All results are limited to organisations that provided data on both the number of outputs and the number of research staff.

2.4.1 Performance per 1,000 research staff

Table 17 gives standardised performance measures for 2013 per 1,000 research personnel. For example, Austrian PROs produced on average 13.0 invention disclosures per 1,000 full-time equivalent (FTE) research staff in 2013. Danish PROs earned, on average, €1,200,000 of license income per 1,000 researchers in 2013.

Table 17 Performance per 1,000 research staff, all PROs, 2013

	AT		DK		FI		NL		NO		SE		All countries	
	Total	*Valid resp-onses*	***Total***	*Valid resp-onses*	***Total***	*Valid resp-onses*	***Total***	*Valid resp-onses*	***Total***	*Valid resp-onses*	***Total***	*Valid resp-onses*	***Total***	*Valid resp-onses*
Invention disclosures	**13.0**	*13*	**26.7**	*9*	**43.1**	*12*	**19.9**	*8*	**31.7**	*16*	**36.7**	*11*	**27.9**	*69*
Patent applications	**7.5**	*14*	**11.0**	*9*	**7.2**	*11*	**7.1**	*11*	**4.4**	*18*	**3.2**	*9*	**6.5**	*72*
Patent grants	**3.7**	*12*	**3.0**	*9*	**2.6**	*10*	**2.9**	*4*	**1.7**	*16*	**6.2**	*5*	**2.8**	*56*
Start-ups established	**0.7**	*9*	**1.2**	*9*	**0.8**	*9*	**2.8**	*11*	**1.6**	*18*	**6.2**	*12*	**2.5**	*68*
License agreements	**4.5**	*9*	**9.4**	*8*	**3.0**	*8*	**4.4**	*9*	**6.3**	*18*	**0.0**	*8*	**5.1**	*60*
License income (million €)	**0.4**	*6*	**1.2**	*8*	**0.2**	*9*	**0.6**	*9*	**0.3**	*15*	**0.0**	*8*	**0.5**	*55*

Source: UNU-MERIT. Note: Limited to respondents that gave both outcome results (e.g. invention disclosures and research staff).

PROs in Finland outperform other PROs on the number of invention disclosures. Danish PROs outperform all other PROs on the number of license agreements and license income. They earn on average 2.6 times more license income than the average across all barometer countries.

Table 18 below gives standardised performance measures for all universities per 1,000 research personnel in 2013. For example, universities produced on average 3.4 patent applications per 1,000 FTE research staff in Norway. For license income, Dutch universities earned on average €400,000 per 1,000 researchers, or approximately €400 per research staff.

Table 18 Performance per 1,000 research staff, all types of universities, 2013

	AT		DK		FI		NL		NO		SE		All countries	
	Total	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*
Invention disclosures	**13.0**	*13*	**27.3**	*7*	**28.2**	*10*	**18.8**	*6*	**30.9**	*11*	**36.7**	*11*	**25.7**	*58*
Patent applications	**6.6**	*13*	**11.1**	*7*	**3.6**	*9*	**7.0**	*9*	**3.4**	*11*	**3.2**	*9*	**5.8**	*58*
Patent grants	**3.1**	*11*	**2.9**	*7*	**1.3**	*8*	**2.6**	*2*	**0.7**	*9*	**6.2**	*5*	**2.2**	*42*
Start-ups established	**0.7**	*9*	**1.3**	*7*	**0.7**	*7*	**2.3**	*8*	**1.4**	*11*	**6.2**	*12*	**2.4**	*54*
License agreements	**4.5**	*9*	**9.6**	*7*	**3.2**	*7*	**3.1**	*7*	**3.5**	*11*	**0.0**	*8*	**4.2**	*49*
License income (million €)	**0.0**	*5*	**0.2**	*6*	**0.0**	*7*	**0.4**	*6*	**0.3**	*9*	**0.0**	*7*	**0.2**	*40*

Source: UNU-MERIT. Note: Limited to respondents that gave both outcome results (e.g. invention disclosures and research staff).

Table 19 below gives standardised performance measures for technical universities per 1,000 research personnel in 2013. For example, technical universities produced on average 11.7 patent applications per 1,000 FTE research staff in Austria. For license income, technical universities in Denmark earned on average €200,000 per 1,000 researchers, or approximately €200 per research staff.

Table 19 Performance per 1,000 research staff, technical universities, 2013

	AT		DK		FI		NL		NO		SE		All countries	
	Total	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*
Invention disclosures	**20.9**	*5*	**30.4**	*3*	**57.9**	*2*	**-**	*-*	**45.0**	*2*	**47.1**	*4*	**33.2**	*17*
Patent applications	**11.7**	*5*	**15.3**	*3*	**7.3**	*2*	**10.5**	*2*	**4.6**	*2*	**5.0**	*3*	**10.6**	*17*
Patent grants	**5.7**	*4*	**3.5**	*3*	**-**	*-*	**-**	*-*	**-**	*-*	**-**	*-*	**3.9**	*11*
Start-ups established	**1.2**	*4*	**1.9**	*3*	**-**	*-*	**3.3**	*2*	**3.4**	*2*	**3.1**	*4*	**2.4**	*15*
License agreements	**5.0**	*3*	**6.6**	*3*	**-**	*-*	**2.7**	*2*	**3.7**	*2*	**0.0**	*2*	**4.5**	*12*
License income (million €)	**-**	*-*	**0.2**	*2*	**-**	*-*	**-**	*-*	**-**	*-*	**-**	*-*	**0.1**	*6*

Source: UNU-MERIT. Note: Limited to respondents that gave both outcome results (e.g. invention disclosures and research staff). Only results for two or more technical universities are provided in order to protect confidentiality.

Table 20 below gives standardised performance measures for universities with a hospital per 1,000 research personnel in 2013. For example, universities with a hospital produced on average 24.9 invention disclosures per 1,000 FTE research staff in Denmark. For license income, universities with a hospital in the Netherlands earned on average €600,000 per 1,000 researchers, or approximately €600 per research staff.

Table 20 Performance per 1,000 research staff, universities with a hospital, 2013

	AT		DK		NL		NO		All countries	
	Total	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*
Invention disclosures	**18.2**	*3*	**24.9**	*3*	**21.3**	*3*	**35.5**	*4*	**27.9**	*14*
Patent applications	**5.7**	*3*	**6.1**	*3*	**5.9**	*5*	**4.0**	*4*	**5.2**	*16*
Patent grants	**4.9**	*3*	**2.2**	*3*	**-**	*-*	**0.7**	*4*	**1.7**	*11*
Start-ups established	**0.5**	*2*	**0.5**	*3*	**1.9**	*4*	**1.3**	*4*	**1.3**	*14*
License agreements	**11.7**	*2*	**14.1**	*3*	**4.1**	*3*	**4.5**	*4*	**6.8**	*13*
License income (million €)	**0.0**	*2*	**0.1**	*3*	**0.6**	*4*	**0.4**	*4*	**0.4**	*14*

Source: UNU-MERIT. Note: Limited to respondents that gave both outcome results (e.g. invention disclosures and research staff). Only results for two or more universities with a hospital are provided in order to protect confidentiality. No data available Sweden, in Finland only 1 university with a hospital replied in order to protect confidentiality their results are not provided.

Table 21 below gives standardised performance measures for other research organisations per 1,000 research personnel in 2013. For example, universities with a hospital produced on average 24.9 invention disclosures per 1,000 FTE research staff in Denmark. For license income, universities with a hospital in the Netherlands earned on average €600,000 per 1,000 researchers, or approximately €600 per research staff.

Table 21 Performance per 1,000 research staff, other research organisations, 2013

	AT		DK		FI		NL		NO		All countries	
	Total	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*	***Total***	*Valid responses*
Invention disclosures	**-**	-	**10.6**	*2*	**110**	*2*	**31.1**	*2*	**43.2**	*5*	**57.5**	*12*
Patent applications	**15.7**	*2*	**7.1**	*2*	**22.4**	*2*	**9.4**	*2*	**14.4**	*7*	**15.7**	*15*
Patent grants	**-**	-	**3.5**	*2*	**7.7**	*2*	**4.1**	*2*	**11.0**	*7*	**8.7**	*14*
Start-ups established	**-**	-	**0.0**	*2*	**1.1**	*2*	**9.0**	*3*	**3.8**	*7*	**3.9**	*14*
License agreements	**-**	-	**-**	-	**-**	-	**23.5**	*2*	**35.0**	*7*	**20.4**	*12*
License income (million €)	**1.6**	*2*	**27.4**	*2*	**0.6**	*2*	**2.5**	*3*	**0.4**	*6*	**2.8**	*16*

Source: UNU-MERIT. Note: Limited to respondents that gave both outcome results (e.g. invention disclosures and research staff). No data available Sweden.

2.5 Panel data

Out of the 94 respondents that replied to the knowledge transfer survey 2014, 53 responded as well to two earlier surveys conducted by UNU-MERIT. This section provides an analysis of the performance over time for KTOs that responded to two or more UNU-MERIT surveys.

Table 22 below gives standardised performance measures for the panel data set per 1,000 research personnel for all PROs across the six barometer countries combined. For example, Austrian PROs that responded to all four surveys produced on average 19.3 invention disclosures per 1,000 FTE research staff in 2010 and 18.0 in 2012.

Table 22 Performance per 1,000 research staff, panel data 2010-2013, all PROs combined

	Austria				
Performance indicators	**2010**	**2011**	**2012**	**2013**	**Valid responses**
Invention disclosures	21.0	17.0	18.0	19.3	5
Patent applications	6.5	5.7	5.6	5.6	5
Patent grants	4.6	4.6	4.6	4.8	4
Start-ups established	1.1	0.2	0.6	0.6	4
License agreements	2.5	3.9	9.3	11.8	5
License income (million €)	-	-	-	-	-

	Denmark				
Performance indicators	**2010**	**2011**	**2012**	**2013**	**Valid responses**
Invention disclosures	37.5	118.1	71.1	70.6	8
Patent applications	12.5	12.0	11.0	12.3	8
Patent grants	3.7	5.6	6.2	6.0	8
Start-ups established	0.5	2.5	0.5	2.1	8
License agreements	3.0	5.9	4.7	8.0	7
License income (million €)	4.9	4.1	6.6	9.8	7

	Netherlands				
Performance indicators	**2010**	**2011**	**2012**	**2013**	**Valid responses**
Invention disclosures	20.5	17.4	16.4	21.3	7
Patent applications	7.9	7.2	7.8	7.2	9
Patent grants	6.0	5.5	2.5	2.7	2
Start-ups established	4.4	3.8	2.8	3.8	10
License agreements	11.0	6.0	7.1	6.3	7
License income (million €)	1.4	0.9	1.3	1.5	5

	Norway				
Performance indicators	**2010**	**2011**	**2012**	**2013**	**Valid responses**
Invention disclosures	24.6	24.2	13.3	16.6	8
Patent applications	4.9	9.5	9.6	6.0	15
Patent grants	3.4	6.6	4.3	6.0	10
Start-ups established	2.7	2.9	2.0	1.1	14
License agreements	15.1	3.1	10.2	11.2	13
License income (million €)	0.2	0.2	0.2	0.3	3

	Sweden				
Performance indicators	**2010**	**2011**	**2012**	**2013**	**Valid responses**
Invention disclosures	8.8	15.3	9.8	12.5	2
Patent applications	-	-	-	-	-
Patent grants	0.0	0.0	8.3	7.6	2
Start-ups established	6.3	51.9	67.9	75.1	2
License agreements	-	-	-	-	-
License income (million €)	0.0	0.0	0.0	0.0	2

Note on the valid responses. The results presented are subject to the following conditions:
1. Data is available on the indicator in question (e.g. invention disclosures).
2. Data is available on the number of research staff.
3. Data as mention under points 1 and 2 are available for all four years (2010 - 2013).
Data for Finland is not available.

For most countries across all indicators, performance has increased over time. There are however some notable exceptions. Danish PROs have for instance seen a substantial increase in license income in the period 2012 and 2013, which most likely partly stems from the increase in the number of license agreements in 2012 and 2013. Austria has also seen a very large increase in the number of license agreements in recent years. The performance in the Netherlands has stayed relatively stable over these four years. Norwegian PROs have however seen quite some fluctuations over time with a very good year in terms of license agreements in 2010 and in 2011 the results dropped significantly. The case of Sweden is a particular one because of the teacher exemption law there which allows inventors to pursue application and commercialisation of their inventions outside of their affiliated institution.

Table 23 gives standardised performance measures for the panel data set per 1,000 research personnel for all PROs across the six barometer countries for the period 2012 and 2013. Similar trends as discussed above can be found in Table 23.

Table 23 Performance per 1,000 research staff, panel data 2012-2013, all PROs combined

Austria				Netherlands			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	14.0	16.4	12	Invention disclosures	17.8	22.2	8
Patent applications	7.0	7.8	12	Patent applications	8.1	7.4	11
Patent grants	4.8	4.7	11	Patent grants	4.3	3.0	4
Start-ups established	0.6	1.1	7	Start-ups established	2.5	3.5	11
License agreements	7.0	8.7	7	License agreements	6.8	5.9	9
License income (million €)	0.6	0.6	6	License income (million €)	0.9	1.1	9
Denmark				**Norway**			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	64.3	63.1	9	Invention disclosures	189.5	92.4	15
Patent applications	10.0	11.3	9	Patent applications	68.5	5.3	17
Patent grants	6.2	6.0	8	Patent grants	34.0	4.5	16
Start-ups established	0.5	1.8	9	Start-ups established	253.0	157.8	16
License agreements	4.1	7.0	8	License agreements	72.1	9.3	16
License income (million €)	5.7	8.6	8	License income (million €)	1.8	0.8	15
Finland				**Sweden**			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	32.3	38.2	12	Invention disclosures	34.2	34.9	10
Patent applications	3.7	5.9	11	Patent applications	2.8	2.7	8
Patent grants	1.8	1.9	10	Patent grants	3.3	3.4	5
Start-ups established	0.5	0.5	9	Start-ups established	16.2	17.8	11
License agreements	0.7	1.7	8	License agreements	0.0	0.0	7
License income (million €)	0.1	0.1	9	License income (million €)	0.0	0.0	8

Note on the valid responses. The results presented are subject to the following conditions:
1. Data is available on the indicator in question (e.g. invention disclosures).
2. Data is available on the number of research staff.
3. Data as mention under points 1 and 2 are available for both the years 2012 and 2013.

Table 24 Performance per 1,000 research staff, panel data 2012-2013, universities only

Austria				Netherlands			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	15.1	17.5	11	Invention disclosures	16.9	18.2	6
Patent applications	5.5	6.1	10	Patent applications	7.2	6.8	9
Patent grants	3.5	3.3	10	Patent grants	2.5	2.7	2
Start-ups established	0.6	1.1	7	Start-ups established	2.2	2.2	8
License agreements	7.9	10.1	6	License agreements	4.1	3.0	7
License income (million €)	0.1	0.0	4	License income (million €)	0.4	0.4	6
Denmark				**Norway**			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	77.9	77.3	7	Invention disclosures	20.6	25.5	10
Patent applications	10.5	12.2	7	Patent applications	3.1	2.5	10
Patent grants	6.1	6.8	6	Patent grants	0.5	0.7	9
Start-ups established	0.6	2.3	7	Start-ups established	1.1	1.2	9
License agreements	4.7	8.0	7	License agreements	1.8	2.3	9
License income (million €)	0.1	0.1	6	License income (million €)	0.1	0.1	9
Finland				**Sweden**			
Performance indicators	**2012**	**2013**	**Valid resp-onses**	**Performance indicators**	**2012**	**2013**	**Valid resp-onses**
Invention disclosures	25.3	31.2	10	Invention disclosures	34.2	34.9	10
Patent applications	2.1	4.2	9	Patent applications	2.8	2.7	8
Patent grants	1.0	1.2	8	Patent grants	3.3	3.4	5
Start-ups established	0.5	0.5	7	Start-ups established	16.2	17.8	11
License agreements	0.8	1.9	7	License agreements	0.0	0.0	7
License income (million €)	0.0	0.0	7	License income (million €)	0.0	0.0	7

Note on the valid responses. The results presented are subject to the following conditions:
1. Data is available on the indicator in question (e.g. invention disclosures).
2. Data is available on the number of research staff.
3. Data as mention under points 1 and 2 are available for both the years 2012 and 2013.

Most of the results presented in Table 22 and 23 are based on the results of universities, Table 24 show gives the standardised performance measures for the panel data set per 1,000 research personnel for universities only across the six barometer countries for the period 2012 and 2013. The sample for other research organisations is too small and therefore not presented here.

3. Conclusions

Most European Knowledge Transfer Offices (KTOs) are young, with 54.8% established after 2005. Furthermore, 51.9% have five or less employees (in full-time equivalents). These results suggest, as found in previous survey conducted by UNU-MERIT, that many European KTOs are still developing experience and capabilities with managing the intellectual property produced by their affiliated university or research institute. Many KTOs could also be struggling with a lack of sufficient staff, 27.8 of the KTO have two or fewer staff. Both of these factors could result in lower performance than expected, in terms of the number of patent applications, patent grants, start-ups, licenses, and license income. This is also seen in the results for Denmark, on average across all PROs KTO staff has increased with 33.5% FTE, and in Austria with

At most PROs the ownership of IP is in the hands of the institution itself exclusively (34.1%) or in some kind of combination between the institution and other parties (38.5%).

Biomedical intellectual property is the largest generator of license revenue, accounting for 83.3% of the total reported license revenue for 2013, followed by ICT at 11.2% and by 'other subject areas' (5.4%). This suggests that the presence of a strong health, biotechnology or medical faculty at a university or research institute is likely to be a major factor in earning license revenue.

Standardised performance measures for 2013 per 1,000 research personnel have shown that Danish PROs outperform other PROs in the barometer countries on patent applications, license agreements and license income. Swedish PROs in terms of patent grants and start-ups, and Finnish PROs lead in terms of invention disclosures. This is the same for universities only except that Swedish universities also lead in terms on invention disclosures.

Standardised performance measures for the panel data set per 1,000 research personnel have shown that public research organisations in across all barometer countries are performing better over time for most indicators. Danish PROs have however seen a substantial increase in their performance in terms of license agreements and license income. The same holds for Austria, although to a lesser extent.