Summary Respondent Report:

ASTP Survey for Fiscal Year 2008

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SUMMARY

This report provides the main results of the Fiscal Year 2008 ASTP survey of ASTP members, with responses from 71 ASTP members serving affiliated universities and 28 ASTP members serving affiliated public research institutes. The focus of this report is on the factors that influence eight knowledge transfer outcomes.

In 2008, almost all ASTP member Knowledge Transfer Offices (KTOs) provided assistance with applying for patents, obtaining licenses, and managing spin-offs. Four other services were less widely provided: negotiating contracts with firms, negotiating contracts with governments, providing incubator facilities, and managing seed capital funds. The provision of these four other services increased with the number of KTO staff (see Section 3).

The majority of KTOs tracked the success of some or all of their spin-offs, with only 17.6% reporting that they did not track spin-offs (see Section 3.1).

Outsourcing of some services is widespread: 85% of KTOs outsourced some work for preparing patent applications while 21% outsourced legal work for research contracts and 36% outsourced legal work for licensing contracts. However, 82.5% of universities and 66.7% of other public research institutes spent less than 25% of their office budget on outsourcing (see Section 3.2).

The eight indicators of knowledge transfer outcomes include the number of R&D agreements, invention disclosures, patent applications, patent grants, USPTO patent grants, licenses executed and spin-offs established, plus the amount of license income earned. Over 90% of KTOs reported one or more R&D agreements, invention disclosures and patent applications. Only about half of the KTOs reported one or more USPTO patent grants in 2008 (See Section 4). For benchmarking purposes, Table 4 gives average output measures, standardized by the number of research staff and research expenditures of the KTO's affiliated institution.

After controlling for the research capabilities of the KTO's affiliated institution, older KTOs reported fewer invention disclosures, patent applications, patent grants, and USPTO patent grants than younger KTOs. This effect appears to be due to more experience with assessing the commercial potential of inventions, with older KTOs licensing a higher share of their patent portfolio than younger KTOs (See Section 5).

The most important single factor influencing knowledge transfer outcomes is the number of KTO staff (see Section 5). For example, increasing the average number of KTO staff at a university by one person is expected to increase the average number of invention disclosures by 10.5% and the average number of patent grants by 20.2%. The substantial effect of increasing KTO staff suggests that a minimum number of KTO staff is required to provide complex knowledge transfer services and to identify potentially valuable IP out of the existing pool of inventions made by researchers at universities or other public research institutes. Many KTOs have not reached this minimum, suggesting that modest investment in extra staff could have substantial benefits in terms of knowledge transfer outputs.

Trends in knowledge transfer outcomes were estimated between Fiscal Year 2007 and 2008 from a panel of ASTP respondents that replied to both surveys. Aggregated over the entire panel, license income increased by 19.6% and invention disclosures by 4.5%. The number of licenses executed fell by 2.5% and the number of patent grants fell by 29.4%.

The most recent comparable data for the ASTP and American AUTM surveys is for 2007. As in previous years, European KTOs outperform American KTOs, producing 1 spin-off for every 53.8 million PPP$ of research expenditures, versus a cost of 87.9 PPP$ per spin-off in the United States). For four other outcome measures (inventions disclosures, patent applications patent grants and license agreements, American KTOs outperform European KTOs.

1. INTRODUCTION

This report provides the main results of the Fiscal Year 2008 ASTP survey on the knowledge transfer activities of ASTP members that serve public sector research institutions such as universities, academic hospitals, government or non-profit research institutes, or research parks or incubators affiliated with these public institutions.

The survey began on March 5, 2009 and was closed on July 10, 2009, with a response rate of 55.9%. Useable responses were obtained from 99 ASTP members based in 21 EU countries and four non-EU countries. Four or more valid responses were obtained from Austria, Belgium, Denmark, Finland, Germany, Ireland, Norway, Portugal, Spain, Sweden, Switzerland, the Netherlands and the UK.

Most ASTP respondents handle the knowledge transfer activities of one or more universities. Other ASTP respondents manage the knowledge transfer activities of non-university public research institutes such as hospitals, government or non-profit research institutes, or research parks and incubators. These are defined in this report as 'other public research institutions'.

For the first time, the 2008 ASTP survey includes a question on the outsourcing of technology transfer activities and on the follow-up of spin-offs.

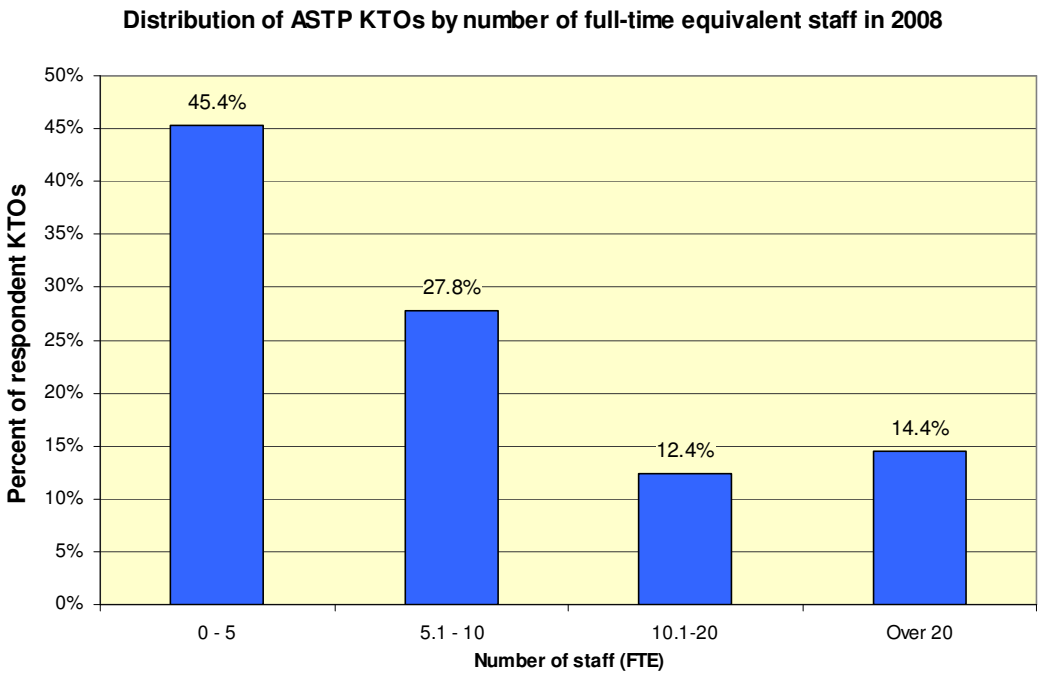
All financial data are given in US dollar purchasing power parities (PPP$), using OECD data on PPP$ in each European country for 2008. This permits comparisons between European countries that use different currencies and between the ASTP results for Europe and the AUTM results for the United States.

2. CHARACTERISTICS OF THE KTOS

ASTP member Knowledge Transfer Offices (KTO) differ by the type of public institute that they serve, the age of the KTO (the number of years since establishment), and by the number of KTO personnel in full-time equivalents (FTEs).

- Seventy-one of the ASTP respondents handle the technology transfer activities of universities, while 28 ASTP respondents were only responsible for other types of public research institutions.
- The average age of a respondent ASTP member KTO is 9.0 years, with 66% founded after 2000 and only 3.2% founded before 1980. The average age is 9.3 years for KTOs representing universities and 8.2 years for KTOs representing other public research institutes.
- The average KTO had 10.7 staff (in full-time equivalents), with 45.4% having five or fewer staff (see Figure 1). There is little difference in the average number of staff for KTOs representing universities (10.9 staff) compared to other public research institutes (10.4 staff).

Figure 1



2.1 Intellectual property ownership

For the 99 ASTP respondents, 72.7% said that only their affiliated institution held the IP rights, 13.1% stated that IP rights were held either by the institution or by others (usually the inventor or the government), and 14.1% stated that the affiliated institution did not own any of the IP. In the latter case, IP rights were held by the inventor.

2.2 Research capacity of the affiliated institution

The performance of a KTO, in terms of indicators such as the number of licenses executed or patents granted, is strongly influenced by the research capacity of the KTO's affiliated institution. A university with a large number of researchers is likely to produce more IP than a university with a small number of researchers. Therefore, all performance indicators are standardized by each of two measures of the research capacity of the affiliated institution: the number of researchers and the amount of research expenditures. Both standardization measures have advantages:

- Standardizing by the number of researchers has two advantages. First, it minimizes differences in research costs across countries. For example, the cost of hiring a researcher of a given quality could be higher in some European countries than in other countries. Second, it provides more representative data, because a higher percentage of ASTP respondents can estimate the number of researchers at their affiliated institution (79.8% of respondents) than the total amount of research expenditures (67.7% of respondents).
- Standardizing by R&D expenditures has one major advantage. It permits comparisons with the AUTM study of the knowledge transfer activities of American universities, which only reports R&D expenditures.

As shown in Table 1, universities affiliated to an ASTP member had a median of 1,561 research staff and median research expenditures of 84 million PPP$, while other public research institutes had a median of 345 research personnel and research expenditures of 38.5 million PPP$. The mean values are notably higher, due to the effect of several very large universities and research institutes. There are two 'outliers' among the group of other public research institutions. Where necessary, these are excluded from the calculation of the performance indicators.

Table 1. Research capacity of affiliated institutions in 2008

	Research personnel			Research expenditures (million PPP$)		
	Valid responses	Median	Mean	Valid responses	Median	Mean
Universities	56	1,500	2,187	47	84.0	161.0
Other public research institutions	23	345	2,123	19	38.5	127.2
Total	*79*	*1,250*	*2,168*	*66*	*80.0*	*151.3*

2.3 KTO characteristics and performance

In addition to the effect of the research capabilities of each KTO's affiliated university or institution, the types of knowledge transfer services provided by the KTO or its performance could be influenced by the characteristics of the KTO itself. The age of the KTO is a measure of potential experience in handling IP issues, while the number of full-time staff is a measure of the resources available to the KTO to assess IP or find licensees.

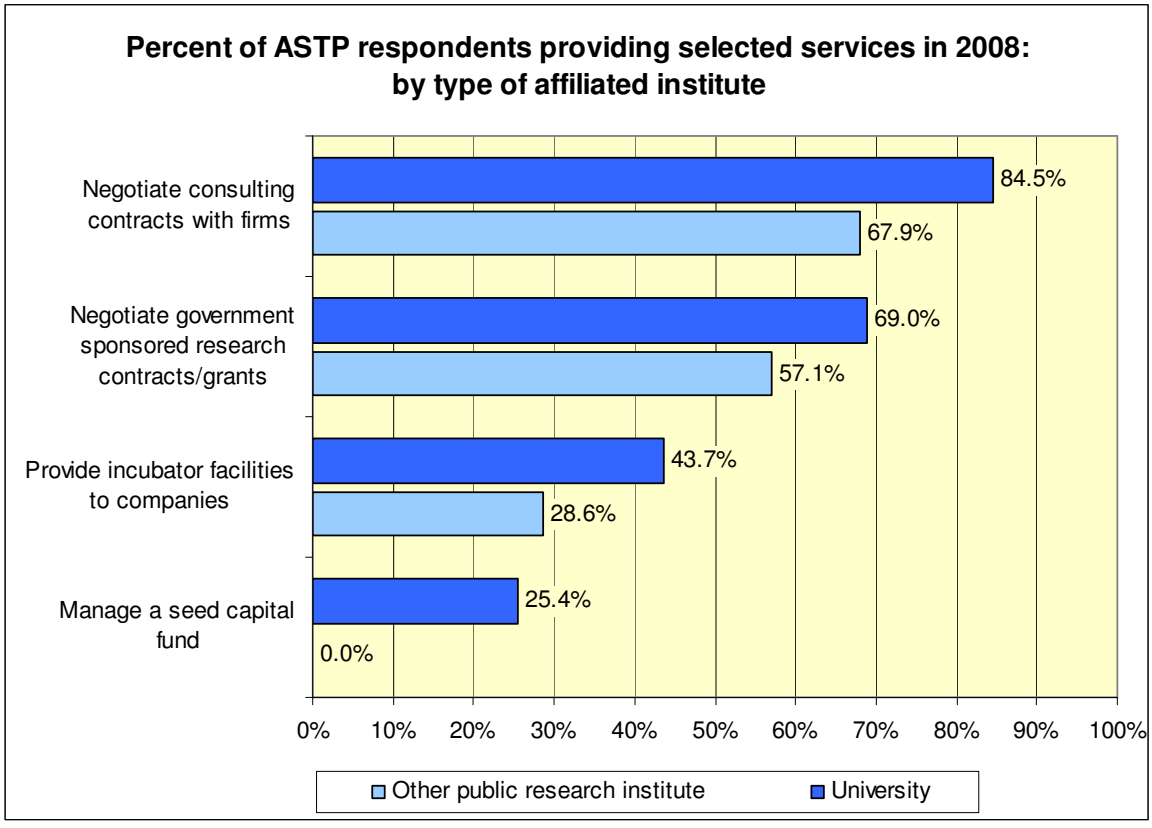
The age of the KTO is positively correlated with the number of researchers at the affiliated institution, but not with research expenditures. However, the number of full-time staff at

the KTO is positively correlated with both the number of researchers and research expenditures at the affiliated institution. This means that standardizing performance indicators for research staff or expenditures will partly, although not entirely, control for the effect of the KTO's age and staffing levels on performance.[2] For all performance indicators, regression analysis is used in section 5 below to determine if the KTO age (a proxy for experience) and KTO staff size influence performance outcomes.

3. TYPES OF SERVICES PROVIDED BY KTOs

In 2008, almost all ASTP member KTOs provided three types of services to their affiliated institutions: assistance with intellectual property such as applying for patents and registering designs (94% of ASTP respondents), negotiating or arranging licenses (95%) and help with creating or supporting spin-off firms (88%). As shown in Figure 2, four other knowledge transfer services are less widely supported: negotiating contracts with firms, negotiating government sponsored research contracts, providing incubator facilities, and managing a seed capital fund.

Figure 2

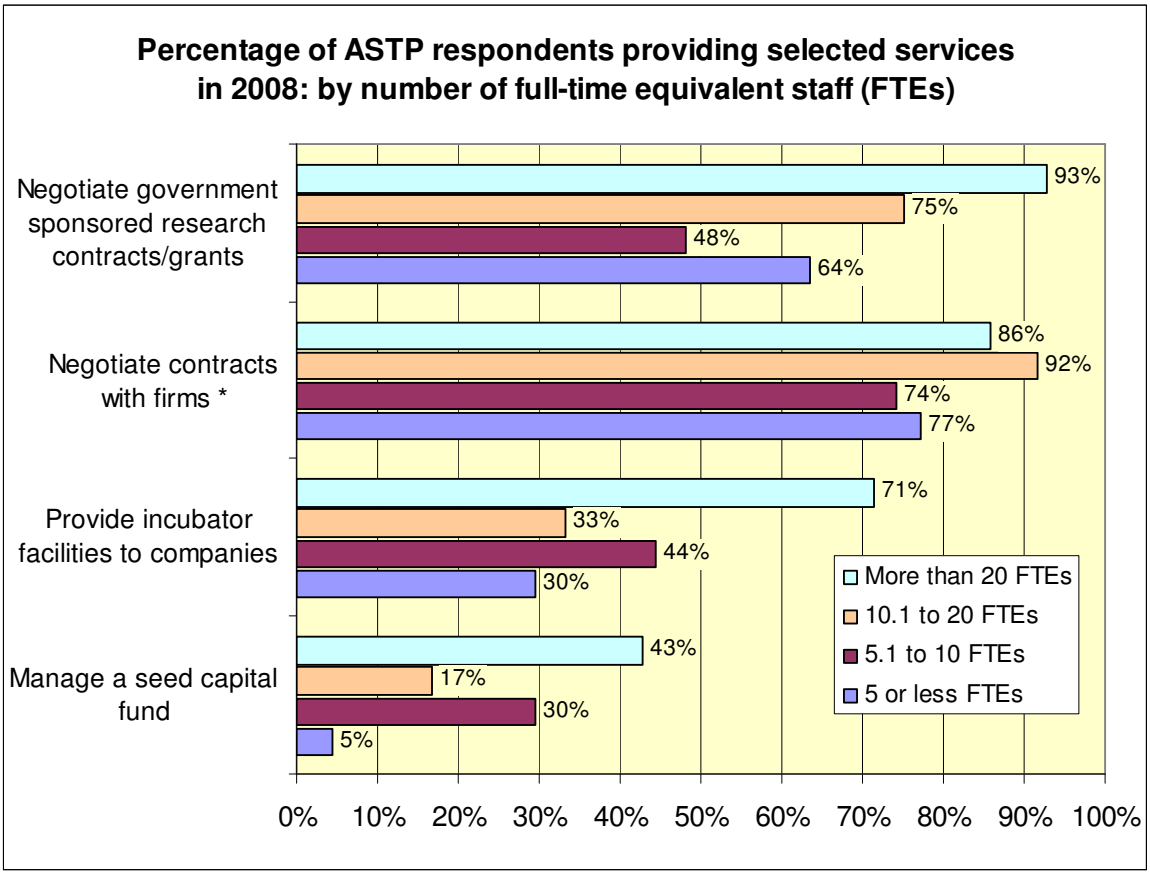


Whether or not the KTO can provide these additional services is not influenced by the experience of the KTO (as measured by its age). However, the ability of the KTO to provide three of these services is influenced by staffing levels. As shown in Figure 3, the percent of KTOs that manage a seed capital fund, provide incubator facilities, and

[2] The correlation coefficient for KTO age and the number of research employees at the affiliated institution is 0.43. The correlation coefficient for the number of full-time KTO staff and research expenditures at the affiliated institution is 0.61 and 0.42 for the number of KTO staff and the number of research employees at the affiliated institution ($p < 0.000$ for all three correlations).

negotiate government contracts generally increases with staffing levels.[3] There is no statistically significant correlation between staffing levels and negotiating contracts with firms. In addition, the *number* of services provided increases with the number of KTO staff.[4]

Figure 3



* No statistically significant differences by staffing levels.

3.1 Tracking spin-offs

Although not specifically a service, ASTP members were asked for the first time if they "track the success of your institution's spin-offs over time". Tracking could help KTO staff to improve support for spin-offs or with identifying successful spin-off opportunities.

Of 85 ASTP respondents that answered the question on tracking spin-offs, 48.2% reported that they tracked all of them, 34.1% reported that they tracked some of them, and 17.6% reported that they did not track spin-offs. The probability of tracking spin-offs (all or some of the time) increased with the number of spin-offs reported in 2008,[5] indicating that greater recent experience increased the probability of tracking spin-offs. However, the age of the KTO and staffing levels are not correlated with tracking the success of spin-offs.

[3] The correlation coefficients are 0.29 between staffing levels and providing incubator facilities ($p = 0.004$), 0.21 for negotiating government contracts ($p = 0.04$), and 0.30 for managing a seed capital fund ($p = 0.003$).
[4] The correlation coefficient between the number of full-time equivalent staff and the number of services provided is 0.313 ($p = 0.002$).
[5] The average number of reported spin-offs in 2008 is 3.8 for KTOs that track all spin-offs, 3.1 for KTOs that track some spin-offs, and 1.7 for KTOs that do not track spin-offs.

3.2 Outsourcing

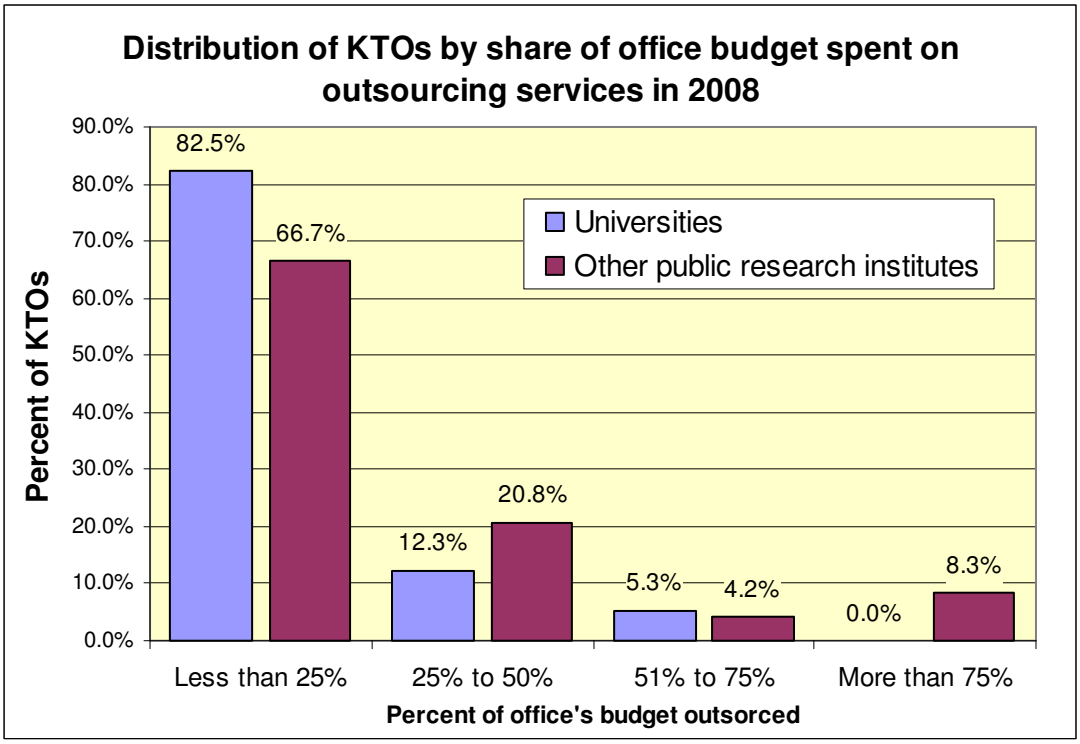
Almost all respondent KTOs outsource some of the necessary work to prepare patent applications (84.8%), whereas a smaller percentage outsource legal work for research contracts (21.2%) and for licensing contracts (36.4%) (see Table 2). The percentage of KTOs that outsource legal work for licensing contracts is considerably larger among non-university than university KTOs (50% versus 31%). Neither the age nor staffing levels of the KTO affects whether or not some services are outsourced.

Table 2. Percent of KTOs that outsource some services

	KTOs for universities	KTOs for other public research institutions	All KTOs
Preparing patent applications	83.1%	89.3%	84.8%
Legal work for research contracts	19.7%	25.0%	21.2%
Legal work for licensing contracts	31.0%	50.0%	36.4%

Respondents were also asked to report the percentage of their office's budget which was spent on outsourcing, with four possible categories (see Figure 4). A large majority of KTOs serving universities, 82.5%, spent less than 25% of their office's budget on outsourcing services. None of the KTOs serving universities spent over 75% of their office budget on outsourcing.

Figure 4



Results based on 69 respondents out of 75 that reported some outsourcing.

4. KNOWLEDGE TRANSFER OUTCOMES

The survey collected data for eight knowledge transfer outcomes in 2008:

1. The number of R&D agreements between the affiliated institutions and companies
2. The number of invention disclosures
3. The number of priority patent applications
4. The number of technically unique patent grants, for all jurisdictions
5. The number of USPTO patent grants
6. The number of licenses or option agreements with companies
7. The number of spin-offs established.
8. The amount of license income earned

4.1 Average outcomes

Table 3 gives the average number of each performance outcome for universities and other public research organisations represented by ASTP respondents. Almost all ASTP respondents for universities reported one or more R&D agreements (only 2.2% of university respondents reported zero agreements in 2008), invention disclosures and patent applications. The percent of respondents reporting zero outcomes is highest for USPTO patent grants, at 47.3% for universities and 52.4% for other public research institutes, and for spin-offs from other public research institutes, at 60%.

Table 3. Mean outcomes for affiliated universities and other public research institutes in 2008

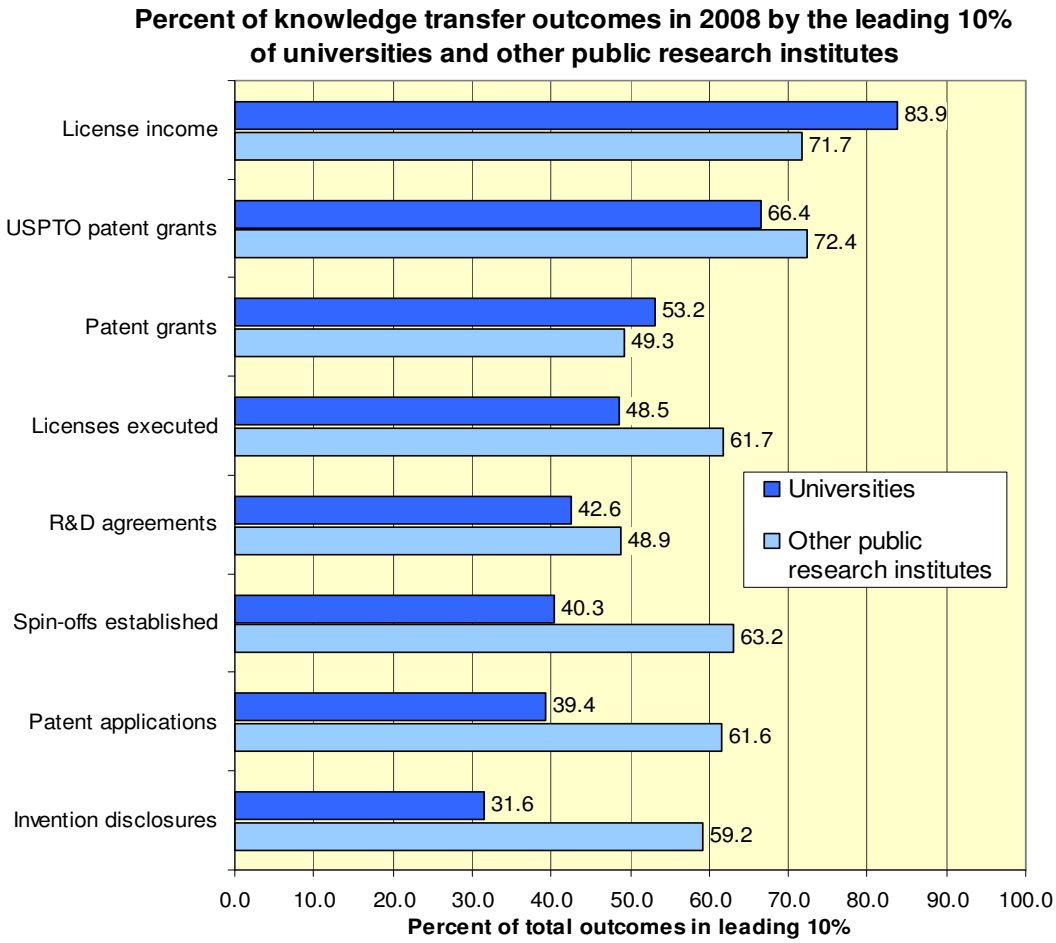
	Universities			Other public research institutes		
	N[1]	Mean	Percent zero[2]	N[1]	Mean	Percent zero[2]
R&D agreements	45	193.6	2.2%	17	75.8	5.9%
Invention disclosures	66	37.0	1.5%	26	35.8	7.7%
Patent applications	69	14.0	5.8%	27	13.4	14.8%
Patent grants	57	7.5	22.8%	22	3.2	40.9%
USPTO patent grants	55	2.8	47.3%	21	2.8	52.4%
License income	45	1.58m	17.8%	22	2.52m	21.7%
Licenses executed	63	10.8	19.0%	24	18.7	8.3%
Spin-offs established	67	3.1	23.9%	25	0.8	60.0%

1: Number of KTOs reporting results for each performance measure (including zero outcomes).
2: Percent of respondents reporting 'zero' for each outcome. For example, 1.5% of 66 ASTP members reported zero invention disclosures.

4.2 Output share of the leading 10% of respondents

A consistent finding of all research on the knowledge transfer activities of KTOs is that a small percentage of universities and other public research institutions account for a large share of each outcome. As shown in Figure 5, the leading 10% of universities or other public research institutes affiliated with ASTP KTOs account for a larger than expected share of each outcome. For example, 10% of the affiliated universities account for 83.9% of all license income reported by respondent universities in 2008.

Figure 5



Results limited to KTOs that report data for each indicator.

Generally, the level of concentration is much lower for outcomes that are far from the market, such as invention disclosures, compared to close-to-market outcomes such as licenses, license income, and spin-offs. For example, 2,443 invention disclosures were reported by universities. The leading 10% of these universities accounted for 772 or 31.6% of these disclosures. The share of the leading 10% of universities is 39.4% of reported patent applications and 42.6% of reported R&D agreements.

4.3 Standardized performance indicators

Table 4 gives average standardized performance indicators for each of the eight knowledge transfer outcomes in 2008. In order to control for difference in the size of the KTO's affiliated institution, the performance outcomes are given per 1,000 research staff and per million PPP$ of research expenditures. These standardized indicators are also measures of average productivity levels, as they measure the number of outputs per level of 'inputs' measured in research personnel and research expenditures. Of note, the standardization method is imperfect because it is based on 2008 inputs, whereas outcomes such as patent grants and license income will be based on several years of investment. However, the level of each input at most responding institutions is unlikely to change dramatically over a few years.

For both standardized indicators, more output indicates higher productivity. For example, the universities affiliated with ASTP KTOs produced, on average, 18.3 invention disclosures per 1,000 research staff in 2008, whereas other public research institutes only produced 13.0 invention disclosures per 1,000 research staff in this year. Using this indicator, other research institutes perform better than universities for patent grants, USPTO patent grants, license agreements, and license income, but universities perform better for invention disclosures, patent applications, and the number of established spin-offs.

With the exception of the indicator for license income, which gives the cost of investment to earn license income (see the footnote to Table 4), the second indicator gives the number of outputs produced per million PPP$ of research expenditures in 2008. Compared to other research institutes, universities produce more output per unit of research expenditures for patent grants (19.5 versus 16.9) and license agreements (13.2 versus 7.5). There is little difference in productivity for patent applications, USPTO patent grants, and research agreements. Other research institutes are more productive for license income, spending 68.3 million PPP$ to earn 1 million PPP$ of license income. In comparison, universities spend, on average, 80.4 m PPP$ to earn 1 million PPP$ of license income.

Table 4. Output performance in 2008, by type of affiliated institution

	Per 1,000 research staff		Per million PPP$ research expenditures	
	Universities	Other research institutes[1]	Universities	Other research institutes[1]
Invention disclosures	18.3	13.0	3.7	4.2
Patent applications	7.0	5.8	11.0	11.7
Patent grants	4.0	5.7	19.5	16.9
USPTO patent grants	1.6	2.1	41.5	43.8
License agreements	5.2	8.1	13.2	7.5
License income	0.8m PPP$	1.2m PPP$	80.4m PPP$[2]	68.3m PPP$[2]
Spin-offs established	1.5	0.3	44.2	171.2
Research agreements	100.3	56.0	0.8	0.9

Notes: All analyses are limited to respondents that gave both outcome results (invention disclosures, patent applications etc.) and the denominator value (either the number of researchers or total research expenditures in their affiliated institution).

1: There are two outliers for 'other public research institutions': one is excluded only from the results for license income and the other is excluded from all results except for license income.

2: The outcome for license income per million PPP$ of research expenditures equals the cost to earn 1 million PPP$ of licence income. For example, universities earn, on average, 1 million PPP$ of license income per 80.4 million PPP$ of research expenditures.

5. FACTORS INFLUENCING PERFORMANCE

The number of outputs could be influenced by the characteristics of both the KTO and its affiliated institution. For example, older, experienced KTOs could be better than younger KTOs at obtaining licenses and earning license income. Larger KTOs with more staff could have more resources than smaller KTOs to identify invention disclosures and

undertake the necessary work to obtain patents. In addition, outputs should increase with the size of the affiliated institute and should be higher for institutes with a technology or science focus, or which have a health faculty (proxied by the presence of a hospital). The incentives of public researchers could also influence outcomes. For example, researchers could be more likely to bring new inventions to the attention of the KTO staff if they obtain direct financial benefits (for instance if they own the IP rights) or career benefits (if patents are considered in academic promotion).

Simple correlations between the characteristics of KTOs and affiliated institutions and each outcome can be misleading because of the effect of other important variables on each outcome. For example, KTO experience, measured by the age of the KTO office, is positively correlated with the number of invention disclosures, spin-offs, license agreements, license income and R&D agreements. However, age has no effect on standardized performance outcomes, which controls for the effect of differences in the size of the affiliated institution.

The best method of determining the influence of each characteristic on outcomes is to use regression to control for the effect of other factors. Ten factors were included regressions for each of the eight outcomes. These factors included:

1. Whether or not the affiliated institution had a hospital (an indicator for a health faculty).
2. Whether or not the affiliated institution was a technical university.
3. The ratio between FTE staff and the number of research personnel at the affiliated institution.
4. Whether or not IP rights were held by the inventor.
5. The percent of research expenditures funded by the private sector.
6. If the KTO outsourced patent applications (for the outcome indicators of the patent stream) or licensing (for the outcome indicators on the number of licenses and license income).
7. The number of full-time equivalent (FTE) staff at the KTO.
8. The age, in years, of the KTO.
9. The type of affiliated institution (university or other public research institute).
10. The number of research personnel at the affiliated institution.

The first six factors had no effect on any of the performance outcomes, with one exception: the number of invention disclosures increased when the inventor held the IP rights. Due to the lack of an effect for almost all of these six factors, they were excluded from the final regressions given in Table 5, which estimates the effect of the remaining four factors on the number of each outcome. There is no need to use standardized outcome indicators because all regressions include the number of research personnel, which controls for differences in the size of the affiliated institution.

As expected, the number of research personnel is significantly and positively correlated with each outcome, with the exception of USPTO grants, where the coefficient is positive but not significant. This indicates that larger institutions produce more outputs. After controlling for other factors, a university produces fewer outputs than other public research institutes, as shown by the negative coefficient for most outcomes, with the exception of R&D agreements and spin-offs. Of greatest interest here is the effect of two characteristics of the KTO: its size measured in the number of employees and its age measure in years.

Table 5. Factors influencing knowledge transfer outcomes: linear regression coefficients

	Invention disclosures	R&D agreements	Patent applications	Patent grants	USPTO patent grants	License agreements	Spin-offs	License income
Constant	15.45	-20.77	10.77	9.75	7.62	8.27	-0.39	-1.81
KTO FTE employees	4.30***	1.92	3.27***	1.94***	1.77***	0.31	*-0.002*	0.26***
KTO age (years)	*-2.38***	3.00	*-1.68***	*-1.10**	*-1.25***	0.22	0.41	0.27**
University[1]	*-28.70***	23.65	*-27.45***	*-25.52***	*-14.10***	*-11.39*	1.80**	*-3.97**
Research personnel[2]	0.015***	0.08***	0.006**	0.007**	0.003	0.004**	0.001***	0.001*
Model F value	30.1***	9.3***	20.9***	15.6***	17.7***	4.21***	6.51***	11.45***
Model R-square	0.65	0.44	0.56	0.48	0.56	0.22	0.29	0.49

Notes: *** = $p < 0.01$, ** = $0.01 > p < 0.05$, * = $0.05 > p < 0.10$. All regressions were checked for collinearity problems, with none observed.

1. Reference category is ASTP KTOs that represent other public research institutes.
2. Number of research personnel at the KTO's affiliated university or other public research institute.

Surprisingly, older KTOs produce fewer outcomes along the patent stream, as shown by the negative sign on the coefficients for invention disclosures, patent applications, patent grants, and USPTO patent grants. Age has no detectable effect on the number of R&D agreements, license agreements, and spin-offs, as shown by the lack of statistical significance. Age is only positively associated with the amount of license income earned.

One explanation for the effects of age is that older KTOs are more skilled in identifying inventions with commercial potential, resulting in fewer resources spent on patenting inventions with a low probability of being licensed. This conclusion is supported by a small but positive correlation of 0.30 ($p = 0.02$) between the age of the KTO and the percent of its patent portfolio that has ever been licensed.[6] The positive effect of age in the regressions on license income is probably due to older KTOs accumulating more licenses that produce income over time.

The most important result of the regressions in Table 5 is the large positive effect of the number of KTO employees on invention disclosures, patent applications, patent grants, USPTO patent grants, and license income. This indicates that there are large benefits to additional KTO employment after controlling for the effect of the number of research personnel at the affiliated institution, the type of KTO, and the age of the KTO. In contrast, the ratio between KTO staff and research personnel has no effect, as noted above. These results can be explained by the need for a minimum number of KTO staff to provide complex knowledge transfer services.[7]

The effect of KTO size can be illustrated by calculating the marginal effects of increasing KTO staff and research personnel levels by 10% for an 'average' KTO of 9.0 years of age and with 10.7 staff and serving a university with the average number of research personnel (2,168). The results are shown in Table 6 for five outcomes where KTO staffing levels have a statistically significant effect. The regression results estimate that the "average" university in 2008 is expected to produce 43.9 invention disclosures, 16.2 patent applications, 10.3 patent grants, 7.7 USPTO patent grants, and 1.6 million in license income. These are the baseline output levels.[8]

Table 6. Marginal effects of a 10% increase in KTO staff and research personnel at the average university: percent increase in outputs

	Baseline output	10% increase in KTO staff	10% increase in research personnel
Invention disclosures	43.9	10.5%	7.4%
Patent applications	16.2	21.6%	8.0%
Patent grants	10.3	20.2%	14.8%
USPTO patent grants	7.7	24.6%	8.4%
License income	1.6 m	17.4%	13.6%

[6] The correlation is based on 58 respondents (after removing one outlier) that reported both the age of their KTO and the percent of their patent portfolio that had ever been licensed.
[7] The effect is stronger for the number of professional staff at the KTO, but the results in Table 5 use total staff because more respondents were able to provide data for total staff levels.
[8] These are calculated from the coefficients in Table 5.

The second column of Table 6 gives the estimated increase in each output after increasing the number of KTO staff by 10% (approximately by one additional staff member) while keeping each of the other three factors constant, including the number of research personnel. The third column gives the estimated increase in each output after increasing the number of research personnel by 10% (approximately by 217 researchers), with all other factors held constant, including the number of KTO staff. For example, increasing the number of KTO staff by one person is expected to increase the number of invention disclosures by 10.5% (approximately 4.6 disclosures), while increasing the number of research staff by 217 people would increase invention disclosures by 7.4% (approximately 3.2 disclosures).

For all five outputs, increasing the number of KTO staff is a substantially more effective (and cheaper!) method of increasing outputs than increasing the number of research personnel.

A possible explanation for these results is that many European public research institutes are producing a large 'pool' of patentable ideas that are not evaluated for their commercial potential because of a lack of knowledge transfer experts. Consequently, the cheapest method of increasing knowledge transfer outputs is to increase the number of KTO staff that can evaluate ideas and apply for patents. Conversely, if all patentable knowledge produced by public research institutes was already evaluated, the effect of additional KTO staff would be minimal. In this case, the most effective method of increasing output would be to increase inputs, such as the number of research personnel.

These results need to be interpreted cautiously: they are based on a small sample of ASTP respondents, which may not be representative of other European KTOs; they do not include lagged time effects (for instance outputs in 2008 are assumed to depend on 2008 inputs), and linear regression is used, which has several limitations for this type of data which could underestimate the coefficients and consequently the marginal effects provided in Table 6. [9] Furthermore, the ASTP survey data tell us little about the quality of many of the outputs: hiring more KTO staff is expected to increase the number of patent applications and patent grants, but many of these patents could have little commercial value. With these caveats however, the results show that relatively small levels of investment in increasing the number of KTO staff could result in a large positive increase in knowledge transfer outputs.

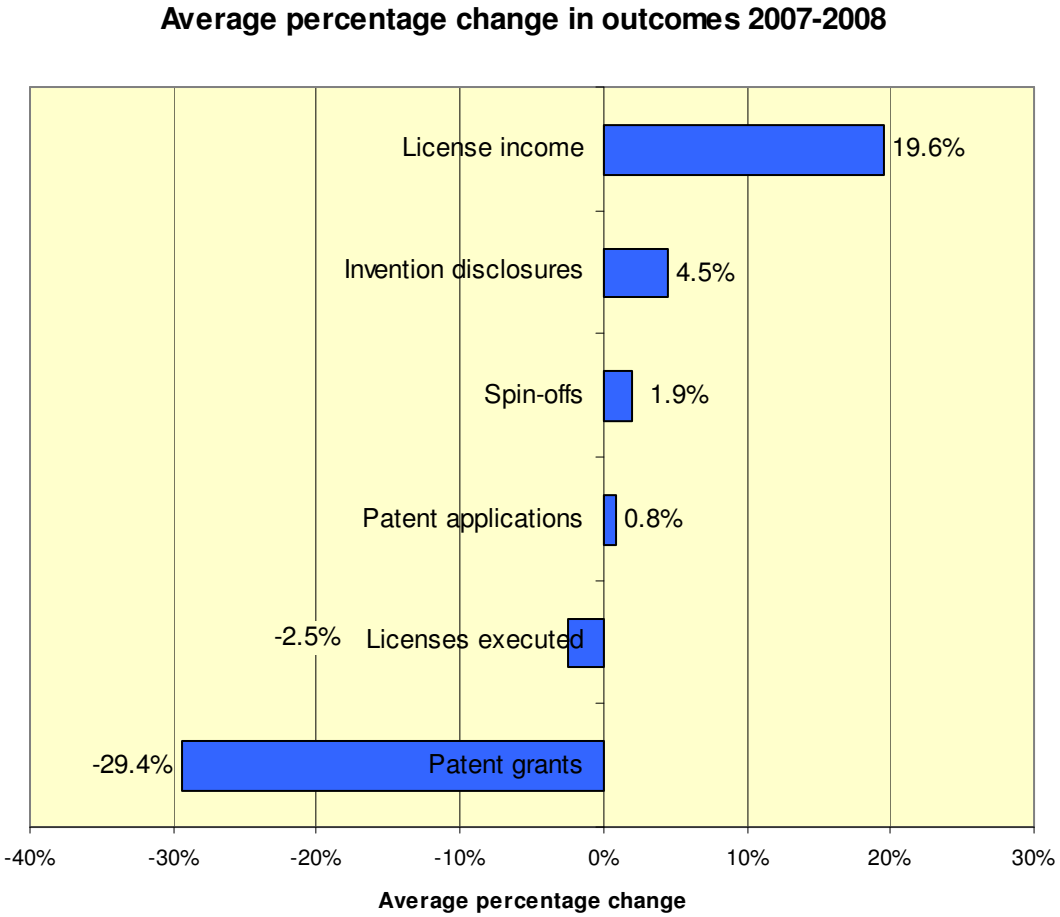
6. TRENDS IN OUTCOMES

Figure 6 gives the percentage change in outcomes between fiscal year 2007 and 2008 for ASTP respondents that answered the relevant questions in both the 2007 and 2008 surveys. License income grew strongly, by 19.6%, possibly because the effects of the global financial crisis only began in Europe in the fall of 2008. There was moderate growth in the number of invention disclosures, spin-offs, and patent applications. In contrast, the number of licenses fell (possibly due to the start of the financial crisis) and

[9] The ASTP survey output data is censored, with no possible values below zero, and there is overrepresentation of zero outcomes, particularly for USPTO patent grants. Under these conditions, a Tobit model is preferable to linear regression, because the linear regression model can underestimate the size of the coefficients and overestimate the constant. However, this study is mostly interested in the relative size of the coefficients (for instance the size of the coefficient for KTO size compared to the coefficient for the number of research personnel), instead of their absolute size (which is expected to be underestimated).

there was a large drop in patent grants of 29.4%. The cause of the fall in patent grants is unknown.

Figure 6

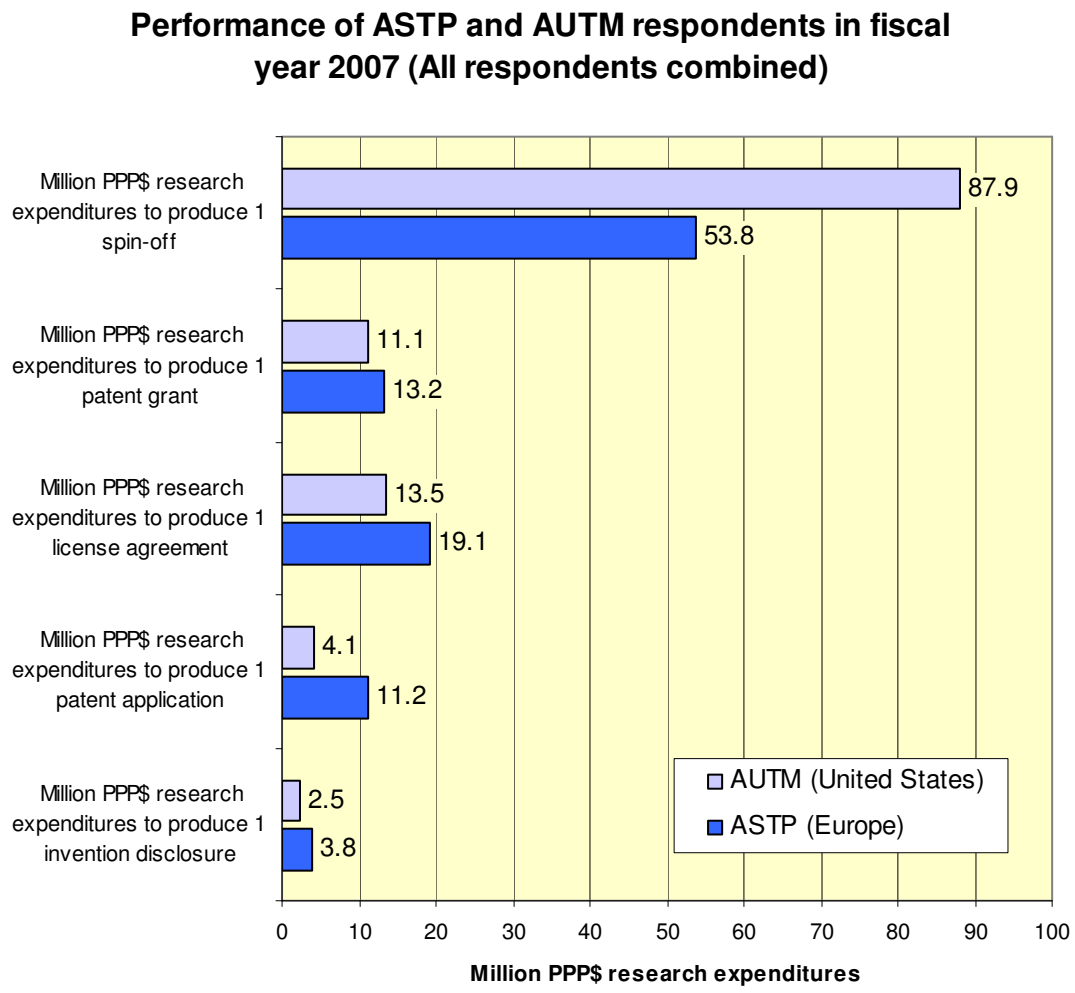


Trends are based on the following number of respondents who answered to both the ASTP 2007 and ASTP 2008 surveys: 59 for invention disclosures and patent applications, 58 for spin-offs, 48 for licenses executed, 45 for patent grants, and 36 for license income.

7. ASTP AND AUTM PERFORMANCE

Figure 7 compares standardized output indicators for ASTP respondents and for the American AUTM, based on the estimated 'cost' in million PPP$ to produce each of five outputs. The results are for fiscal year 2007, since the AUTM does not publish its results until after ASTP. As for fiscal year 2006, AUTM members out-perform ASTP members for all indicators except for spin-offs. One spin-off is produced by AUTM members for every 87.9 million dollars of research expenditures, compared to one spin-off produced by ASTP members for every 53.8 million PPP$ of research expenditures. ASTP output performance is close to that of the AUTM for patent grants.

Figure 7


Performance of ASTP and AUTM respondents in fiscal year 2007 (All respondents combined)
Million PPP$ research expenditures to produce 1 spin-off
87.9
53.8
Million PPP$ research expenditures to produce 1 patent grant
11.1
13.2
Million PPP$ research expenditures to produce 1 license agreement
13.5
19.1
Million PPP$ research expenditures to produce 1 patent application
4.1
11.2
Million PPP$ research expenditures to produce 1 invention disclosure
2.5
3.8
AUTM (United States)
ASTP (Europe)
0
10
20
30
40
50
60
70
80
90
100
Million PPP$ research expenditures