Is it all about the money? How are US Academic Licensing Offices Tasked and Motivated?

by

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1) Abstract

We conducted a survey of Directors of offices of technology transfer at US academic institutions to determine how they are organized, tasked, financed and motivated. We received a response rate of almost 50%, though the respondents' institutions represented closer to 80% of US academic technology transfer activity. By a slight preponderance, offices of technology transfer report up through the administrative side of institutions, and by a very large majority, offices are organized as operating units of the parent institution rather than as independent corporations. Academic institutions spend on average 0.6% of their research budgets on transferring the technology resulting from their research programs, split 45% on patent protection and 55% on operating costs, though we found a very wide distribution of both these figures round the means, reflecting very different operating philosophies at different institutions. Over half the technology transfer programs bring in less money than the costs of operating the program, and only 16% are self-sustaining, bringing in enough income that, after distributions to inventors and for research, enough remains to cover the operating costs of the program. The most important drivers of technology transfer are faculty service and translating the results of research, with revenue maximization a distant third. A surprisingly large number of institutions do not have formal mission statements, but those that do, establish broad, non-financial objectives for their offices, with only two institutions having mission statements that establish revenue maximization as the objective of the offices. Fewer than 20% of offices have incentive compensation plans. Of these incentive compensation plans, fewer than 30% of the performance factors that are taken into account in determining incentive pay are financial measures, with broader, non-financial performance measures accounting for 70% of the factors. We therefore conclude that although a small number of academic institutions have reaped very large rewards from their technology transfer activities – close to $4 billion in transactions that we were able to identify – these rewards appear to be a consequence of programs driven by broader objectives, and not a driving

force for technology transfer as some have recently asserted. In our assessment, fewer than 10% of US institutions' technology transfer programs are primarily motivated by financial return.

2) Background -- Technology Transfer in the United States

In 1980, Congress enacted the Bayh-Dole Act[2] and allowed US universities, teaching hospitals and research institutes to have the automatic right to take title to inventions made with federal funding. In response, these institutions have established offices to seek patent protection on these inventions and license them to existing and new businesses for development and commercialization. Since 1991, the Association of University Technology Managers ("AUTM") has published an annual survey which has quantified the magnitude of this enterprise[3].

The AUTM annual surveys have documented important products that have resulted from Bayh-Dole, and other studies have quantified the considerable contribution to improving public health through the discovery, patenting, licensing and successful development of 140 small molecule and biological drugs, vaccines and *in vivo* diagnostics[4]. In addition, key components of the internet economy—web browsers such as Internet Explorer, portals such as Lycos, email such as Eudora and search engines such as Google – were based on licensed university technologies.

Certainly, some institutions have garnered substantial economic returns from technology transfer. The 2006 AUTM Licensing Activity Survey showed that, overall, US academic institutions received almost $2 billion in licensing income. However, as the results of the Survey also show, this income is highly concentrated in a small number of institutions who have had one big success, most often a drug – the so-called "big hit". In a relatively recent phenomenon, some of these institutions have accelerated receipt of the future royalty streams from these "big hits"

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[2] P.L. 96-517, Patent and Trademark Act Amendments of 1980; See for instance http://www.autm.net/aboutTT/aboutTT_bayhDoleAct.cfm

[3] http://www.autm.net/about/dsp.licensing_surveys.cfm

[4] "The Role of Public Sector Research in the Discovery of New Drugs" Jonathan J. Jensen, Katrine Wyller, Eric R. London, Sabarni K. Chatterjee, Fiona E. Murray, Mark L. Rohrbaugh, and Ashley J. Stevens, Poster at Annual Meeting, Association of University Technology Managers, San Francisco, CA, March 2007

through a sale of their royalty rights to either the marketer of the drug or to specialized investment partnerships and have received even larger, one-time "big hits". Recent lump sum payments have approached $1 billion. Table 1 summarizes some of these transactions, and shows that institutions and their inventors have received almost $3.2 billion from such sales since 1999, with the pace accelerating in recent years.

Another source of "big hits" has been sales of equity, such as Dartmouth's $64 million sale of its equity stake in Medarex in 2000 and Stanford's sale of its $355 million equity stake in Google in 2005. Yet another has been legal settlements, such as the University of California's $200 million settlement with Genentech over human growth hormone in 2000 and $30.4 million with Microsoft in 2007 over accessing interactive content on Web pages, and the 1999 settlement between the University of Minnesota and Glaxo over Ziagen, valued at $300 million.

Table 1 Major Royalty Sales by Academic Institutions and/or their Inventors

Date	Product	Licensor	Amount ($mm)
Jun-90	Neupogen	Amgen	$50
Dec-99	Zerit	Yale University[5]	$125
Jan-01	Thalomid	Children's Hospital	$5
Sep-03	Aldurazyme	LA Biomed[6]	$25
Jan-04	Neupogen/Neulasta (US)	Memorial-Sloan Kettering[7]	$263
Jan-05	Macugen	University of Colorado[8]	$45
Jan-05	Rotarix	Children's Hospital Cincinnati[9]	n/a **
Jan-05	Rotateq	Wistar Institute[10]	$45 *
Jul-05	Emtriva	Emory University[11]	$525
Aug-05	Remicade	NYU/Dr. Vilcek	$46 **
Aug-05	Neupogen/neulasta (Non-US)	Memorial-Sloan Kettering[12]	$142
Oct-05	Humira	Scripps Research Institute[13]	$32 *
Jun-06	Enbrel (US)	MGH[14]	$248
Apr-07	Enbrel (Foreign)	MGH[15]	$284
May-07	Remicade	New York University[16]	$650

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[5] http://chronicle.com/weekly/v48/i06/06a02601.htm

[6] http://www.paulcapitalhealthcare.com/portfolio/overview.htm

[7] http://www.royaltypharma.com/media/pr/2004/MSKCC-01222004.pdf

[8] https://www.cu.edu/techtransfer/downloads/TechTransfer2005.pdf

[9] http://www.paulcapitalhealthcare.com/investmentcriteria/inventors/casestudies/cincinatti.htm

[10] http://webreprints.djreprints.com/1578940928144.html

[11] http://www.royaltypharma.com/media/documents/GileadSciencesandRoyaltyPharmaAnnounce525MillionAgreementwithEmoryUniversitytoPurchaseRoyalt.pdf

[12] http://www.royaltypharma.com/media/documents/RoyaltyPharmaAcquiresInternationalRoyaltyInterestinNeupogenandNeulasta.pdf

[13] http://www.scripps.edu/news/press/102605.html

[14] http://www.boston.com/business/technology/biotechnology/articles/2007/04/19/drug_nets_284m_for_mgh/

[15] ibid

[16] http://www.royaltypharma.com/media/documents/Remicade-RoyaltyPharmaPurchaseofRemicadeRoyaltyFromNYU.pdf

Jul-07	FluMist	U. of Michigan[17]	$35
Dec-07	Lyrica	Northwestern	$700
		Total	$2,707

* Estimate

** Sale by inventor

In spite of, or perhaps because of these financial successes, the involvement of academia in commercializing the results of its research has been controversial. Books have been written on the subject that have blamed research commercialization for everything from increasing undergraduate tuition to destroying the public's trust in the objectivity of the advice and analysis it receives from professors[18]. Others however have documented the inherent entrepreneurialism of faculty[19], while others have demonstrated that only a minority of science faculty attempt to commercialize their research[20].

However, there has been little research on why institutions invest in the resources necessary to commercialize the results of their research. When university presidents speak publicly on the issue, they focus more on the public's right to see a return on the investment of their tax dollars in research grants via the availability of new products and services, rather than on the financial return that they might hope to see. For instance, Dr. Mary Sue Coleman, President of the University of Michigan told the Annual Meeting of the Association of University Technology Managers in 2005:

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[17] http://www.dricapital.com/show_info.php?page_id=28

[18] See for example: Bok, Derek Curtis. **"**Universities in the marketplace : the commercialization of higher education"**:** Princeton University Press, Publisher Princeton, N.J. 2003; Krimsky, Sheldon, **"**Science in the private interest : has the lure of profits corrupted biomedical research?**"** Lanham : Rowman & Littlefield, 2003; Washburn, Jennifer**. "**University, Inc. : the corporate corruption of American higher education" : Basic Books, New York 2005;

[19] Academic Entrepreneurship, Scott Shane;

[20] Thursby and Thursby.

> "I think many people are often confused about why we are interested in technology commercialization, in nurturing start up companies, and in facilitating more patents and license agreements.
>
> It is not about the promise of future revenues that might be generated from this activity.
>
> You heard me correctly. It is not about the money.
>
> Of course, revenue generation serves as an incentive. But first and foremost, technology transfer must serve our core mission: sharing ideas and innovations in the service of society's well-being.
>
> In fact, at Michigan we expect to re-invest institutional gains back into technology transfer efforts. Revenue generation is NOT the ultimate goal. It is simply the means by which we can increase the transfer of new knowledge into the business sector."

A recent study by researchers from the Kauffman Foundation disputed Dr. Coleman's views and emphasized the role of financial incentive in technology transfer[21]. The Foundation's website stated[22]:

> The emphasis among universities to reap big financial rewards through licensing and patenting innovation developed by research scientists is actually impeding the development of new technologies and may be masking the importance of other means of knowledge transfer.

The study went on to claim that universities are motivated in their technology transfer activities by the prospect of "the big hit". They stated:

> Where this has happened, it is because TTO's have been charged with concentrating too heavily on maximizing revenues from the licensing of university-developed intellectual property, rather than maximizing the volume of innovations brought to the marketplace.

The authors describe their research methodology as follows::

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[21] Commercializing University Innovations: Alternative Approaches, Robert E. Litan, Lesa Mitchell, E.J. Reedy, Working Paper, National Bureau Of Economic Research, May 2007

[22] http://www.kauffman.org/items.cfm?itemID=786, accessed 12/22/07

We have spent the last several years discussing the role of TTO's with multiple university leaders and researcher-innovators.

As practitioners of technology transfer, their conclusions did not comport with our experiences. One possible source for the discrepancy is that the Kaufman Foundation did not include in their discussions what is probably the most reliable source of information on what drives academic technology licensing offices, namely the leadership of those offices themselves. While it certainly can be argued that technology transfer offices have a vested interest in preserving the status quo, it cannot be denied that they are a very important source of perspective on the subject, so we decided to carry out a systematic study to find out the role of various drivers of behavior in technology transfer decision-making, focusing on the leadership of those offices.

3) Methodology

We developed a survey instrument and implemented it in the Survey Monkey system[23]. The questionnaire consisted of 17 questions which were a combination of multiple choice questions and open ended questions, some requesting quantitative data, some requesting qualitative information and some requesting opinions. The questionnaire is shown in the sidebar.

We sent the survey, via email, to the Association of University Technology Managers' (AUTM's) list of the most senior individual in each member institution who is responsible for technology transfer on a full time basis, the so-called "Director's List". The list is compiled from a number of sources:

- Self identification in AUTM's annual membership renewal process
- Self identification in registration for attendance at AUTM's annual meeting
- Identification by AUTM from the attendance list for the AUTM annual meeting

We applied to AUTM's Statistics and Metrics Committee for access to the Director's List, and our request was approved.

The list AUTM supplied to us was worldwide and contained some 702 entries. We first sorted it by Country and then by Institution, which yielded 425 entries ostensibly from the US. Inspection

[23] http://www.surveymonkey.com/

of the name of the institution or the individual's email address showed that 17 were in fact non-US institutions, one was a for-profit corporation, while for 16 institutions, there were two individuals who were identified as the most senior licensing individual for the same campus of the same institution. In these cases, we selected one of the two by inspecting their respective job titles. This yielded 391 useable email addresses.

We launched the Survey, via email invitation, on November 27, 2007. Reminders were sent, via email, on December 4, December 10 and December 12. Fifty-one responses were returned as "Undeliverable" or "I have retired". Therefore 340 invitations to participate in the Survey were sent and presumably received by the recipient.

We received 165 usable responses, a 48.5% response rate. 112 of the respondents replied to every question.

We downloaded the responses, sorted them by institution and inspected the responses for duplicate responses from the same institution and campus and found none. When we observed obvious errors in the financial responses (for example, thousands instead of millions), we corrected them. In cases in which it was not clear what the respondent meant, we called the respondent to check the figure.

In this paper, we report the responses to every question and report the number of the responses we received to that question or questions. In the sections where we look for correlations between different types of performance and behavior, for consistency we analyzed only the 112 complete responses.

4) Results

a) Respondents

The first question asked was whether the respondent was a university, hospital, research institute or other. The results are shown in Table 2. The overwhelming majority of respondents were at universities.

Table 2 Type of Respondent

Type of Institution	Number	%
University	126	76.4%
Research Institute	23	13.9%
Hospital	14	8.5%
Federal Laboratory	2	1.2%
Total	165	

We next asked whether the institution was publicly owned or privately owned. The results are shown in Table 3. Publicly owned institutions made up more than 60% of the respondents.

Table 3 Ownership of Institutions

Ownership	Number	%
Private	63	38.2%
Public	102	61.8%
Total	165	

b) Organization of Offices

Next we asked how the office of technology transfer was organized – whether it was an operating unit of the institution or an independent corporation such as a research foundation. The results are shown in Table 4. 86% of the offices were organized as units of the institution and only 14% were separate corporations.

Table 4 Organizational Structure of Technology Transfer Offices

Organizational Structure	Number	%
Within Institution	142	86.1%
Independent corporation	23	13.9%
Total	165	

Of the 23 offices organized as independent corporations, all but one were associated with public institutions while one was associated with a private institution. Corporately, public universities are governmental entities and so are subject to certain contractual constraints. They frequently find it advantageous to assign ownership of, and responsibility for licensing,

their intellectual property to a research foundation which is an independent 501(c)3 non-profit corporation and is not subject to the legal constraints of a governmental entity.

Finally we asked how the office reported within the institution – through the academic side of the organization, i.e, ultimately to a Provost, or administratively, i.e., ultimately to a Vice President or Executive Vice President, or to an independent Board. Reporting through the administrative side was somewhat more common, with a small proportion reporting directly to the President/Chancellor

Table 5 Reporting Structure of Organizations

Reporting Structure	Number	%
Academic	55	33.7%
Administrative	81	49.7%
Independent Board	13	8.0%
Both/President/Chancellor	9	5.5%
Other	5	3.1%
Total	163	

c) Volume of Research Support

We asked the reporting institutions to report the volume of research they carried out. The total reported was $35.7 billion, which is 78.5% of the $45.4 billion in total research support that was reported to the 2006 AUTM Licensing Activity Survey[24]. This indicates that our data is more representative of the totality of US academic licensing activity than the 48.5% overall response rate would indicate. We note however that three federal laboratories reported to our survey; federal laboratories do not report to the AUTM Licensing Activity Survey.

d) Size of Technology Transfer Offices

We asked respondents to report the total employment of their offices, divided between professional staff and support staff. The total reported employment is shown in Table 6

[24] http://www.autm.net/about/dsp.pubDetail2.cfm?pid=41

Table 6 Total Staffing of Reporting Institutions

Staff Category	Number of FTE's	Number Reporting
Professional Staff	729	153
Support Staff	587	134
Total	1,316	

For comparison, respondents to the 2006 AUTM Licensing Activity Survey reported total employment of 1,831.7 FTE's, with support FTE's slightly exceeding professional FTE's. Respondents to our survey therefore employed 71.8% of the employment reported to AUTM, confirming the conclusion of the previous section that our data are more representative of total US technology transfer activity than the overall survey response rate would indicate.

For purposes of subsequent detailed analysis, we assigned size variables to institutions based on both the size of their total research expenditures and on the basis of the total size of their technology transfer office. The cohorts and the number in each cohort were as follows:

Table 7 Cohort Definitions and Populations (Universities only)

Cohort	Research Expenditures ($ million)	Number in cohort	Total FTE's	Number in cohort
Very Small	Up to $50	20	1-3	9
Small	$51-100	23	4-5	33
Medium	$101-250	45	6-10	42
Large	$251-500	24	10-24	36
Very Large	>$500	39	>25	34

e) Budgeting Process

The expenses of running a technology transfer office can be broadly divided between patent costs, normally spent externally, and personnel and other operating costs. We next asked respondents to tell us whether they had separate patent and operating budgets or were given a combined budget, implying they had the flexibility to spend their budget between the two categories as they saw fit. The results are shown in Table 8. 60% of institutions had separate patent and operating budgets.

Table 8 Budgeting Procedures

Budget Procedure	Number	%
Separate Patent and Operating Budgets	78	60%
Combined Patent and Operating Budgets	53	40%
Total	131	

We next asked respondents how big their patent and operating budgets were. The totals for 114 institutions are shown in Table 9.

Table 9 Technology Transfer Budgets

Budget Category	Amount	%
Patent Budget	$93,636,000	44.2%
Operating Budget	112,838,500	53.3%
Unspecified	5,361,000	2.5%
Total	$211,835,500	

Respondents reported spending roughly 20% more on operations – salaries, travel, services, etc. than on patent protection. This is the first hard data of which we are aware of the relative balance between personnel and legal expenditures in US offices of technology transfer, though an extensive model developed by Brandt et al. based on staffing levels reported to the AUTM Survey combined with data from a number of surveys of technology transfer salaries[25] came to a similar conclusion.

The 112 institutions which separately reported their operating budgets had total staffing of 925, implying an average operating cost per staff member of $121,988 annually.

For those institutions that reported their operating and patent budgets separately, we calculated the ratio of patent budget to operating budget. A ratio of 1.0 would indicate that an institution spent as much on patent protection as on operations. We found an extremely broad spread of values, reflecting an equally disparate spread of operating philosophies. As

[25] "Do Most Universities Lose Money on Their Technology Transfer Activities?" Karrie D. Brandt, Eric J. Stevenson Janine B. Anderson, Catherine L. Ives, Michael J. Pratt, and Ashley J. Stevens; Poster at Annual Meeting, Association of University Technology Managers, Phoenix, AZ, February 2005

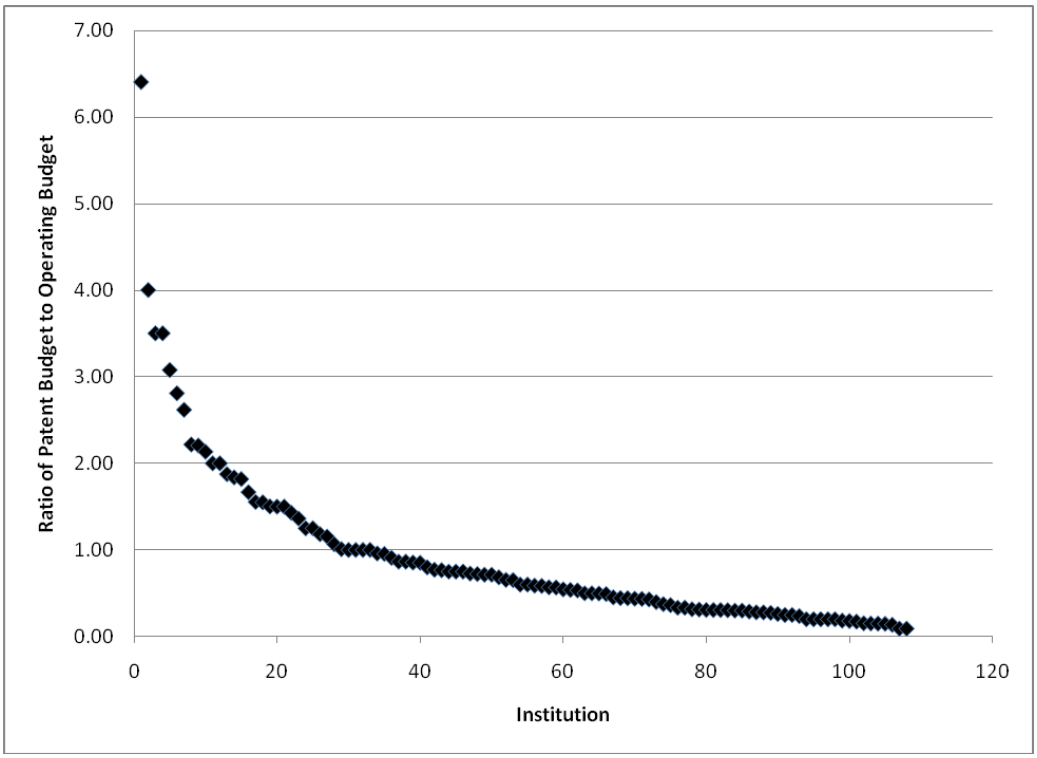
shown in Table 10, the range ran from a 6.4:1 ratio at one extreme (though this was at an institution with a relatively low overall level of activity -- $16k expenditure on patents and $3k on operations. The highest ratio at an institution with a substantial level of activity was 3.5:1 -- $700k on patents and $200k on operations) to a 0.092:1 ratio (expenditure of $60k on patents and $600k on operations) at the other extreme. The mean was 0.91:1.

Table 10 Variation in Ratio of Institutional Patent and Operating Budgets

Statistical Measure	%
Mean	91.9%
Median	60.0%
Std Dev	94.9%
Minimum	9.2%
Maximum	640.0%

Figure 1 shows the distribution of this ratio.

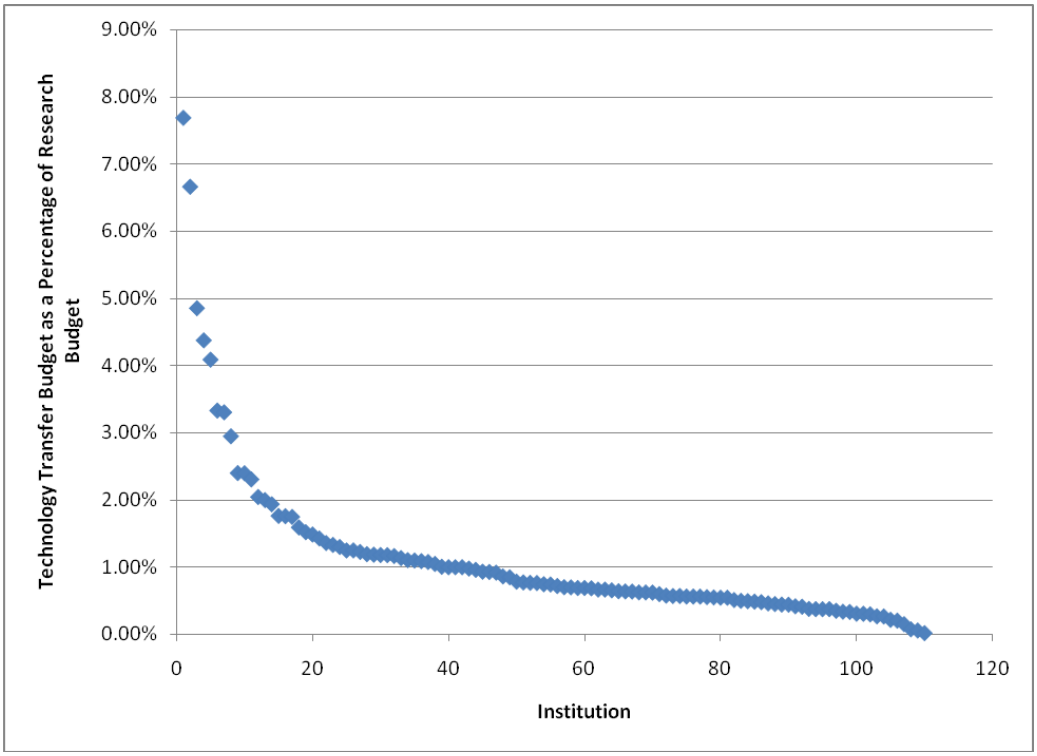
Figure 1 Ratio of Patent Budget to Operating Budget by Institution



The research budgets of the 116 institutions that reported their technology transfer budgets totaled $26.5 billion, implying that these institutions spend 0.59% of their research budgets on protecting and commercializing the results of that research.

As with the relationship between patent and operating expenditures, there is a considerable variation between institutions in the relationship between technology transfer expenditures and total research expenditures, from a high of 8% to a low of 0.01%. This distribution in this ratio is shown in Figure 2 below.

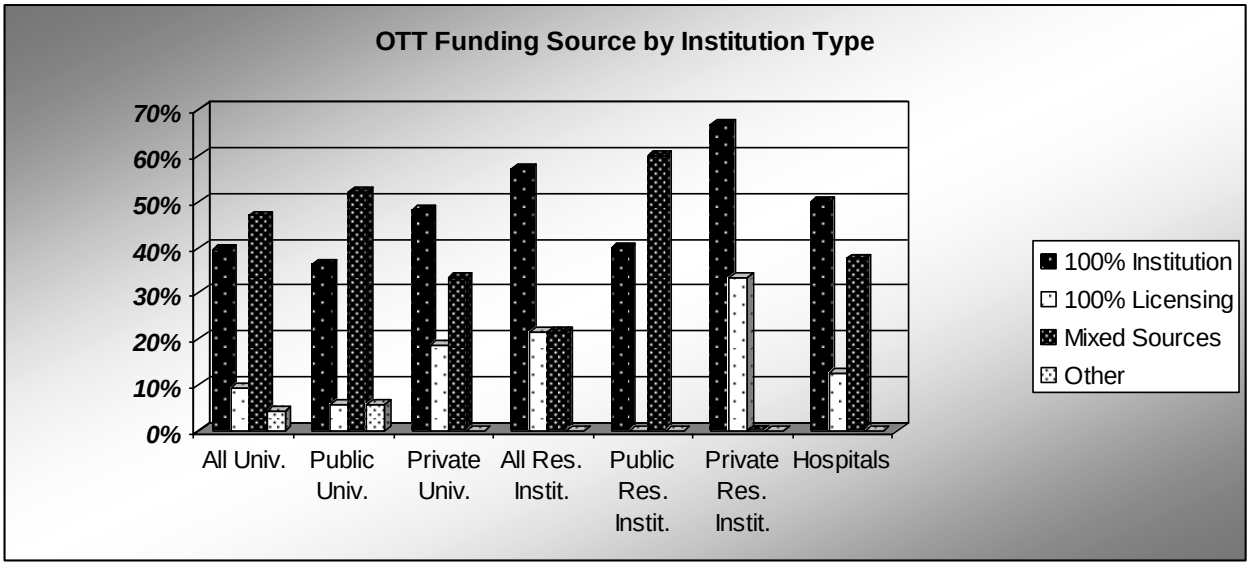
Figure 2 Ratio of Technology Transfer Budget to Total Research Expenditures by Institution



f) Sources of Budget

Next we asked respondents how their technology transfer budgets were financed. One hundred and twenty six institutions reported the mechanism by which their budget was financed. The number of institutions reporting all or part of their budget coming from different sources is shown in Figure 3.

Figure 3 Sources of Technology Transfer Office Budget



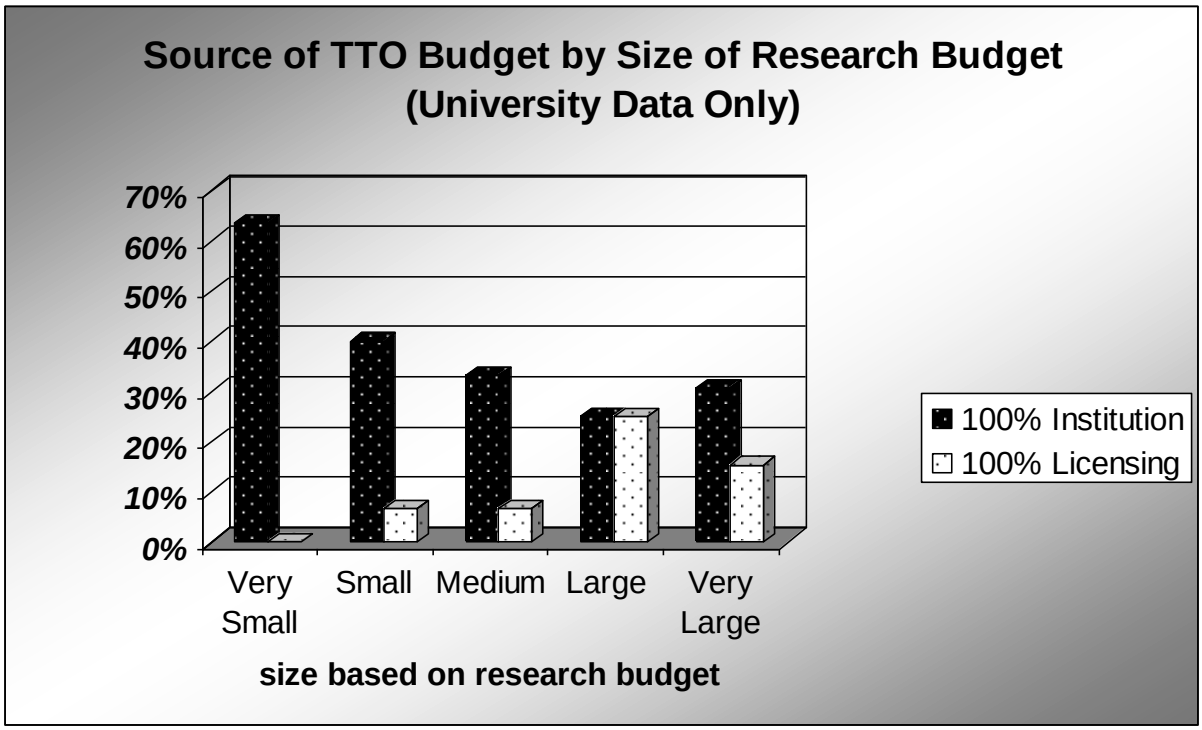
This analysis shows that most TTO's receive their budget from a variety of sources. We found that 47% of universities receive part of their budget from the institution and part from licensing revenue. This reflects the reality (discussed in more detail below) that while many TTO's make money, few make enough to cover all of their expenses without some contribution from the institution. For Research Institutions, 57% are entirely funded by their institutions, and at Hospitals, 38% are fully-funded by their institutions.

g) Factors Impacting How the TTO Budget is Financed

We examined how the source of the TTO budget correlated with the total research funding of the institution.

We found a very clear correlation between the size of a university's research budget and how its TTO is financed. As shown in Figure 4, at very small universities, over 60% of TTO's are entirely funded by the institution, while none are funded entirely out of licensing income. In contrast, at large and very large universities, a significantly larger number of TTO's are funded entirely from licensing income, and relatively few are funded entirely by the institution.

Figure 4 Source of TTO Budget by Size of University Research Budget



i) <u>Operating Results</u>

We did not ask for data on the income the offices generated from their licensing activities. However, we did ask respondents to report the financial contribution their office made to its institution.

As discussed by Brandt et al. in reference 25 above, the profitability of an office depends on the view taken of income. There are many claims on licensing income. As a requirement of Bayh-Dole, part of licensing income must be shared with inventors. The balance is required to be spent on research and education, which in practice means that part of the income is shared with some combination of the Inventor's laboratory, department and college to be spent on research, with the institution retaining only a portion to offset the operating costs of the office. The financial contribution of the technology transfer operation to the institution therefore depends on whether the

calculation includes the portion of income that goes to the inventors, the portion of income that is distributed and spent on research, or just the portion that is retained to reimburse the patent expenditure and operating costs.

We therefore asked the institutions to characterize their financial performance as follows:

Category	Definition
Loss Making	Total expenses exceed total income
Gross Profitable	Total income exceeds total expenses
Net Profitable	Total income less distribution to inventors exceeds total expenses
Self-Sustaining	Total income less distribution to inventors, colleges/labs, provost, university etc. exceeds total expenses

The results are shown in Table 11. Over 50% of the institutions lose money on their technology transfer operations, while only 16% are self-sustaining, retaining more out of net income after distributions to inventors and for research than is spent on patent protection and operating costs. These results show that technology transfer is considerably less financially beneficial to institutions than was predicted by the model of Brandt et al., which predicted that only 42% were loss making and that 30% of institutions were self-sustaining.

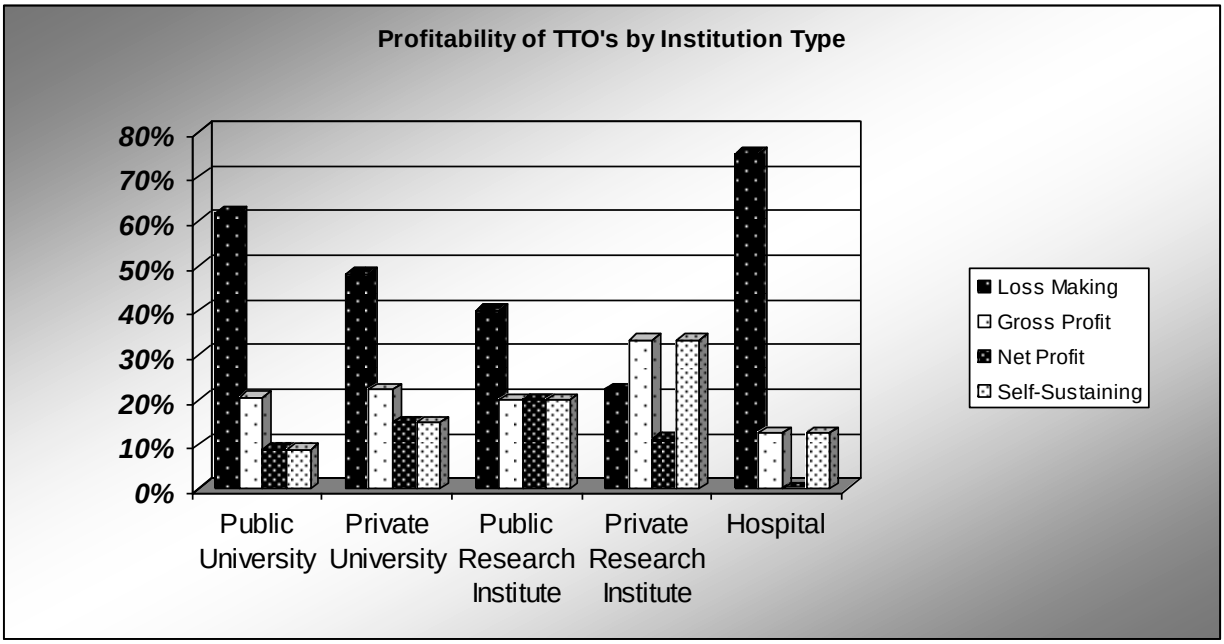
Table 11 Financial Contribution to Institution from Technology Transfer

Financial Contribution	Number	%
Loss making	68	52.3%
Gross profitable	27	20.8%
Net profitable	14	10.8%
Self sustaining	21	16.2%
Total	130	

h) Factors Impacting Profitability

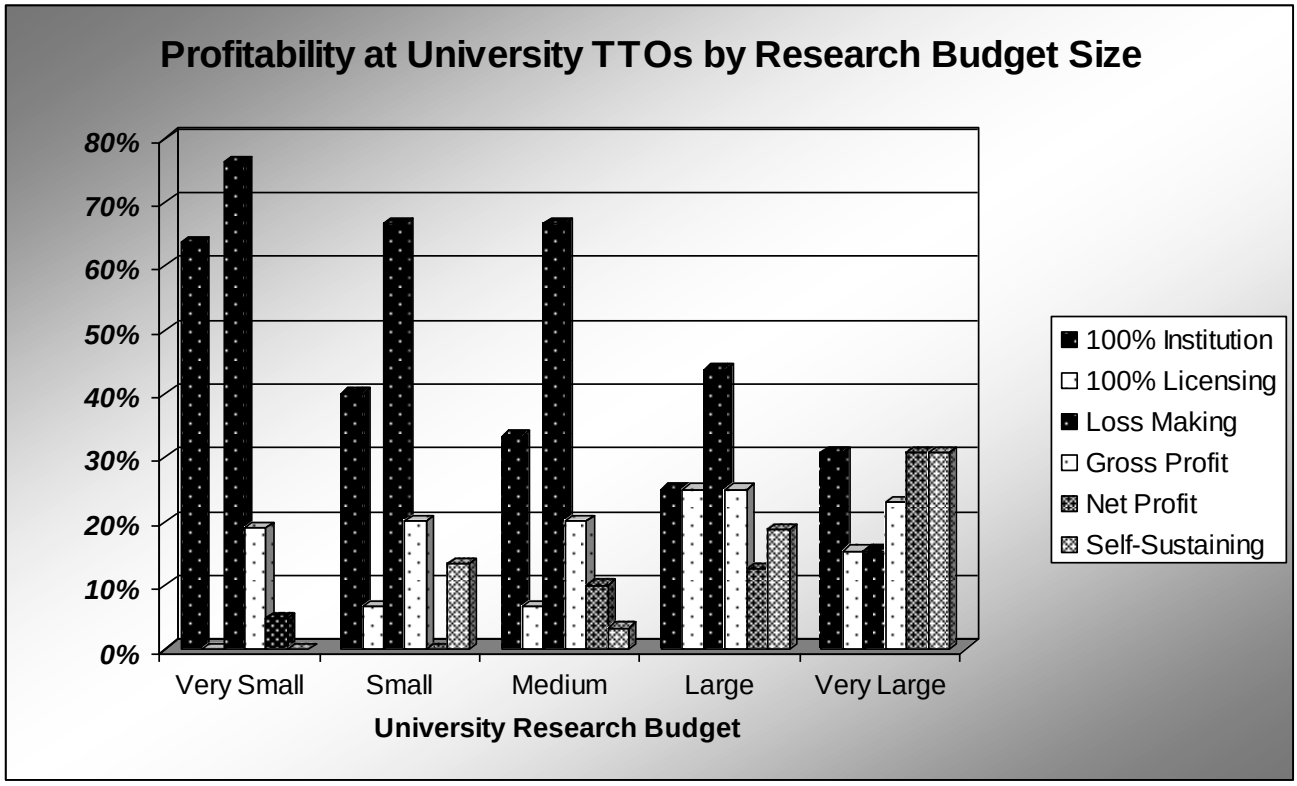
We found that research institute TTO's were more profitable than those of universities and hospitals, and that private institutions were more likely to be profitable than public institutions, as shown in Figure 5.

Figure 5 Profitability of TTO's by Type of Institution



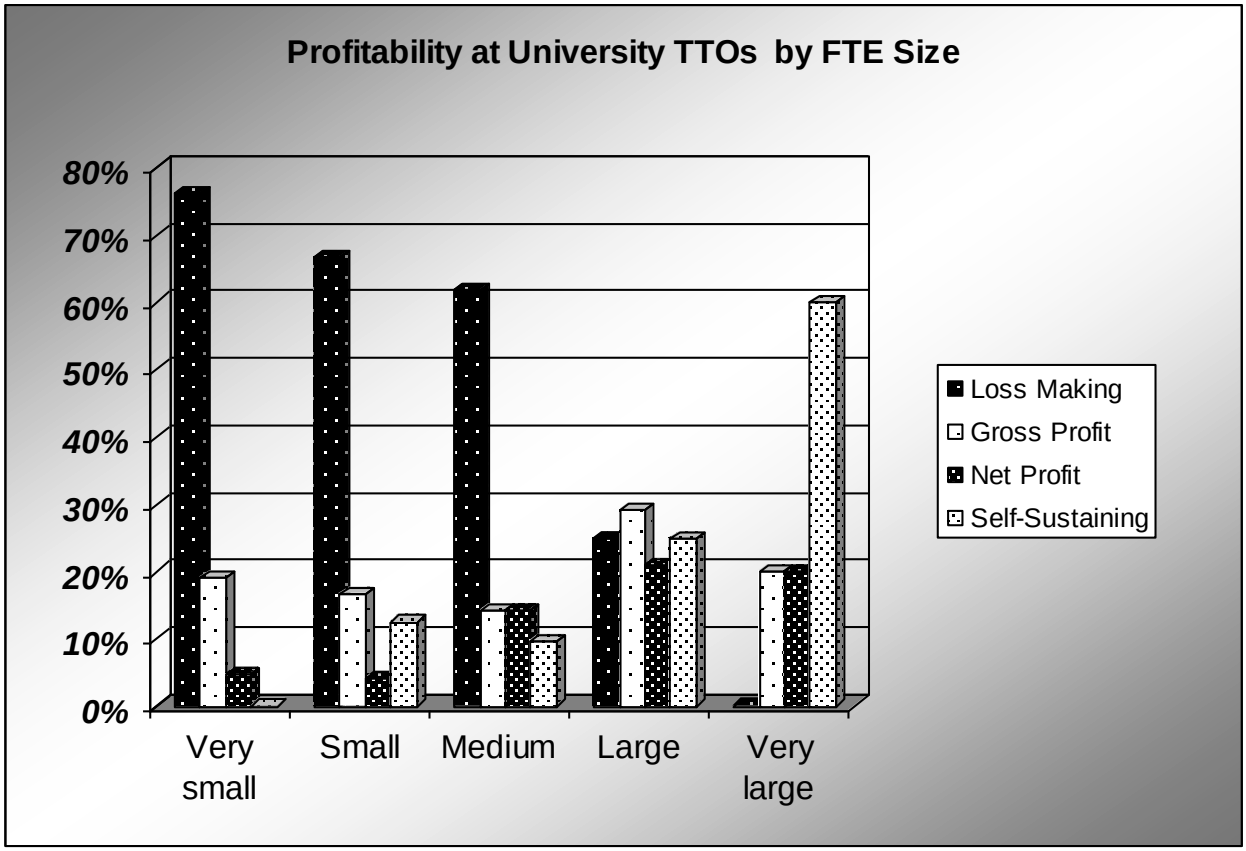
We found a direct correlation between the size of an institution's research budget and its profitability. The larger the research budget, the more likely the office was to be profitable, as shown in Figure 6. At very large schools, 15% are loss-making, and 31% are self-sustaining. By contrast, at very small schools, 76% are loss-making and none are self-sustaining. The relationship between size and profitability is almost linear – as the research budget of the institution increases, the profitability of the TTO increases.

Figure 6 Profitability of University TTO's versus Research Budget



We also looked at how the profitability of TTO's correlates with the size of the office. The results are shown in Figure 7. We found that the correlation of TTO profitability with the size of the office closely follows the correlation of profitability with total research budget. None of the very large universities are operating at a loss, and none of the very small universities are self-sustaining.

Figure 7 Profitability of University TTO's versus Office Size



This conclusion confirms the findings of Brandt et al., who found that the greater the age, FTE count and research budget of a TTO, the more likely it was to be profitable. They found that the TTO's of only those institutions which were 15 years old and had a research budget greater than $500 million and had a total staffing of 20 FTE's were all profitable, a very stringent set of conditions.

Reinforcing the relationship between staffing levels and profitability, a 2006 study by the Milken Institute[26] went so far as to calculate that an incremental investment of $1 in OTT salaries would generate an additional $6 in license income.

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[26] "Mind to Market: A Global Analysis of University Biotechnology Transfer and Commercialization" Ross DeVol and Armen Bedroussian, Anna Babayan, Meggy Frye, Daniela Murphy, Tomas J. Philipson, Lorna Wallace, Perry Wong and Benjamin Yeo, Milken Institute, Santa Barbara, CA, September 2006 (available at: http://www.milkeninstitute.org/pdf/mind2mrkt_2006.pdf

We also looked at the relationship between reporting structure and profitability and found no significant correlation.

i) Drivers of Technology Transfer

The next section of the survey dealt with the informal drivers of technology transfer in an institution. By asking Directors of TTO's how they rank possible drivers of behavior, we hoped to understand how TTO's prioritize the forces shaping their behavior in their daily decision making.

First we asked the respondents what drives the office of technology transfer. Respondents were asked to rank 6 factors in order of priority from 1 to 6:

- Revenue maximization
- Faculty service
- Research results translation
- Industrial sponsored research income
- Risk management
- Other

Table 12 shows how many institutions ranked each factor as the most important driver of their office. Faculty service was ranked first most often, followed by translating research results. Maximizing revenue was ranked most important by only 11.5% of institutions.

We did not include "Economic Development" as an option, which anecdotally is reported to be a significant driving force at publicly owned institutions, which may explain the relatively high number of "Other" responses.

Table 12 Top Ranked Drivers of Technology Transfer

Driving Factor	Number of Institutions Ranking Factor First	%
Faculty service	51	39.2%
Translating research results	45	34.6%
Revenue maximization	15	11.5%
Other	15	11.5%
Research Support	4	3.1%
Risk Management	0	0.0%
Total	130	

i) Factors Impacting Drivers of Technology Transfer

The drivers were broadly similar for both universities and research institutions, with research results translation being the most important factor at research institutions while faculty service was most important at universities. At hospitals, research results translation was again the most important factor, but financial factors – revenue maximization and research support – were relatively more important than with universities and research institutions.

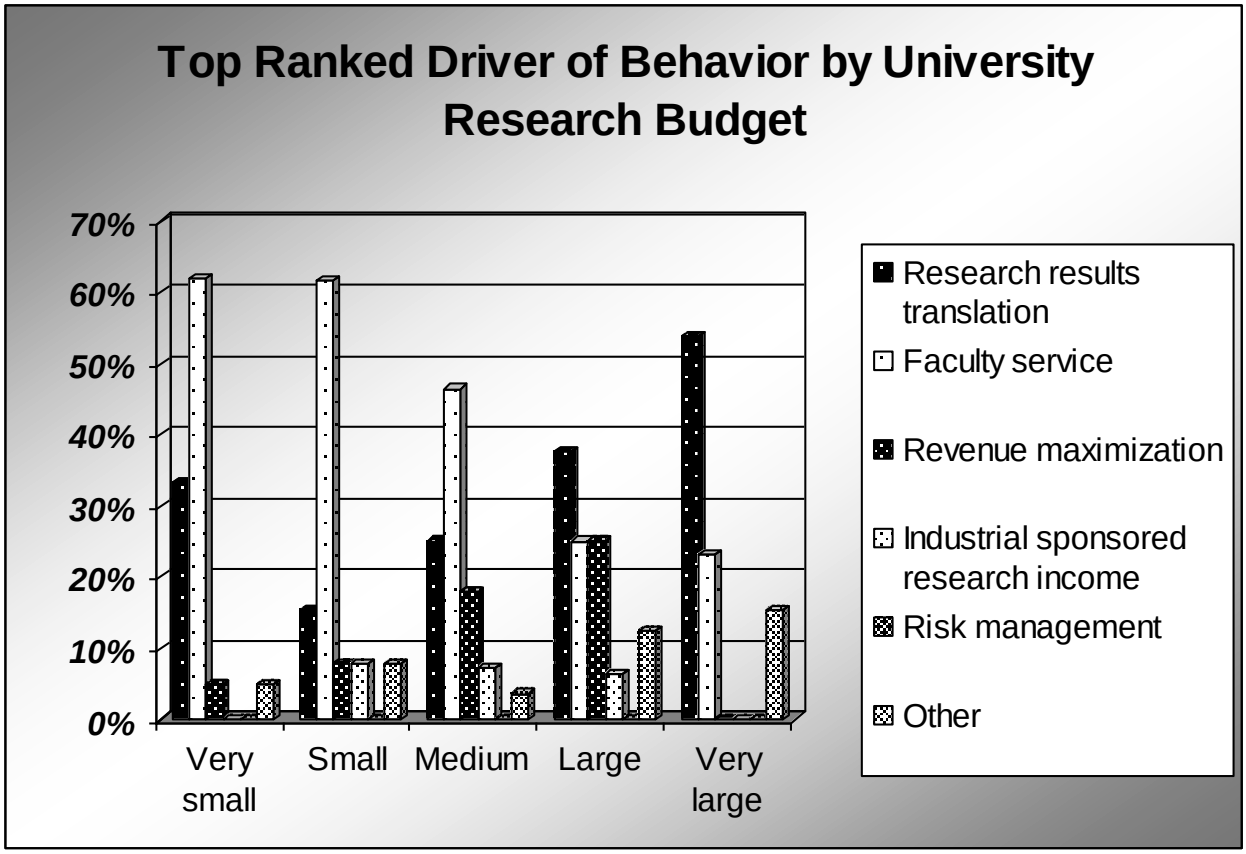
Table 13 Top Ranked Driver of Technology Transfer by Type of Institution

Type of Institution	Top Ranked Driver
Public Univ.	Faculty Service
Private Univ.	Faculty Service
Public RI	Research Results Translation
Private RI	Faculty Service
Hospital	Research Results Translation/Other

As shown in Figure 8, we found that as the size of the university increases, the top driver changes from Faculty Service (over 60% in small and very small universities) to Research Result Translation (35% and 54%, respectively at Large and Very Large universities). The choice of Revenue Maximization as the top driver increases linearly from Very Small to Large schools, but

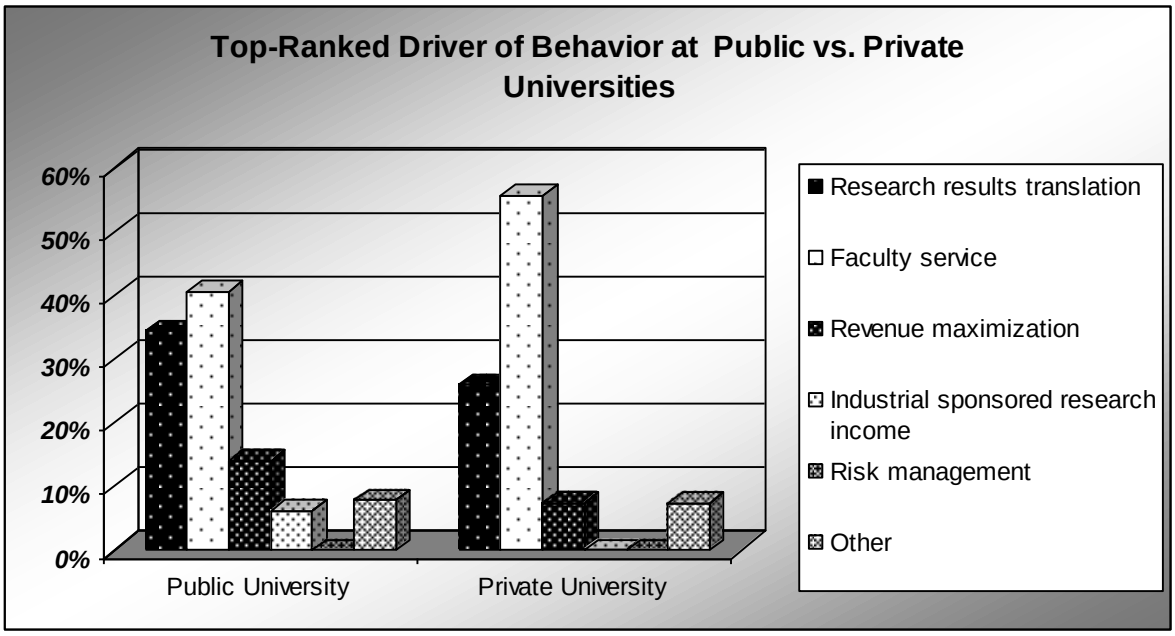
is not a factor at any Very Large Schools. Industrially Sponsored Research Income was listed as top driver at so few schools as not to be significant.

Figure 8 Driver of TTO Behavior versus Total Research Budget



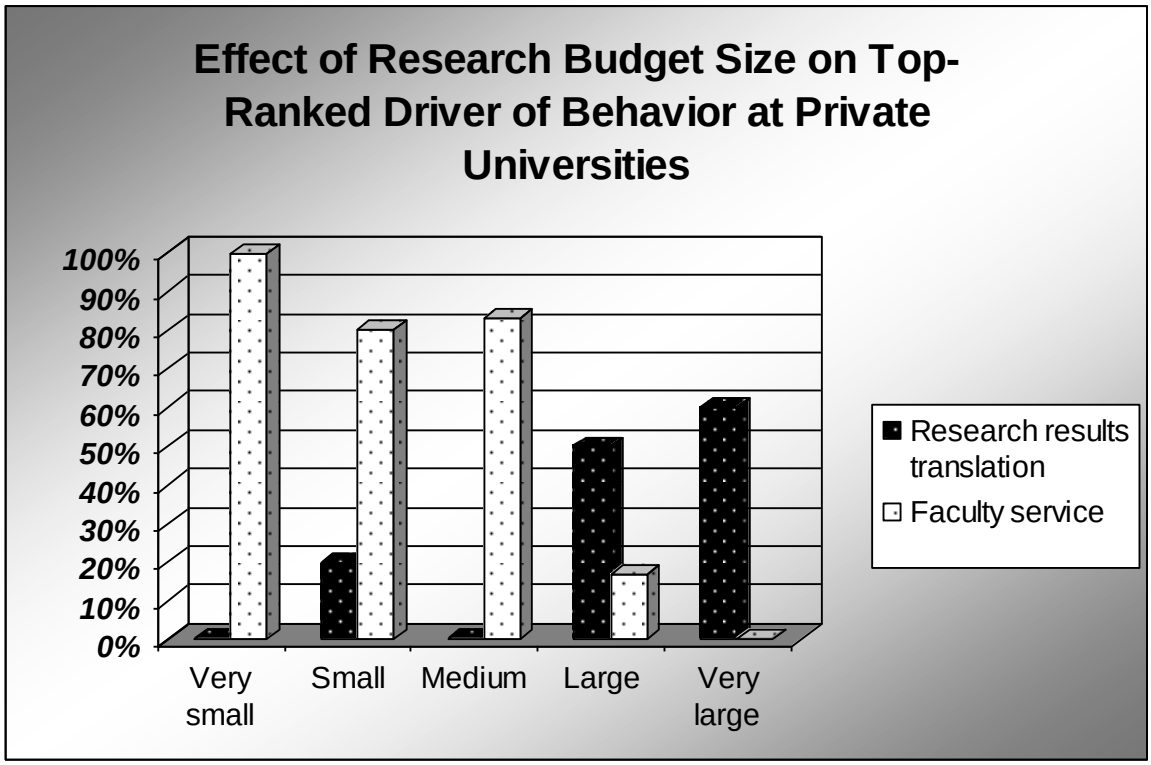
As shown in Figure 9, when we compared public and private universities, we found that Faculty Service is the top ranked driver at a much higher rate at private universities than at public universities (56% vs. 41%, respectively), and Research Result Translation is chosen by a greater number of public universities than private universities (34% vs. 26%); Revenue Maximization was listed at the number one driver at 14% of public universities versus only 7% of private universities.

Figure 9 Top Ranked Driver of Technology Transfer versus University Ownership



As shown in Figure 10, when we looked at the top ranked driver of TTO behavior we found a steady decrease in the importance of faculty service to research results translation as total research expenditures increase.

Figure 10 Top Ranked Driver of TTO Behavior versus Total Research Expenditures



We looked at whether the top driver of TTO behavior correlated with the organizational structure – i.e., do the priorities of the TTO change if the TTO reports to the administrative side of the university versus reporting to the academic side, and found no significant difference.

Finally, we examined whether having revenue maximization as the top driver of technology transfer translated into enhanced profitability. The results are shown in Table 14 below. There is no clear correlation between the two.

The results of these analyses show that an industry standard seems to have been adopted throughout the profession. Translating research results, and providing a service to the faculty are clearly the primary drivers of OTT behavior, whether the OTT is large or small, private or public or whether it is making money or losing money.

Table 14 Top Drivers of TTO Behavior Based on Profitability (All Institutions)

Profitability	No.	Research Result Trans.	Faculty Service	Revenue Max-imization	Industrial Sponsored Research	Risk Manage ment	Other
Loss Making	58	31%	45%	12%	9%	0%	7%
Gross Profit	24	33%	38%	8%	0%	0%	13%
Net Profit	12	33%	42%	25%	0%	0%	8%
Self-Sustaining	18	33%	39%	11%	0%	0%	17%
Total	112	32%	42%	13%	4%	0%	10%

j) Technology Transfer Office Mission

We next asked institutions if the technology transfer office has a formal mission statement. The results are shown in Table 15. A surprising number of offices do not have a formal mission statement.

Table 15 Technology Transfer Offices with a Formal Mission Statement

Formal Mission Statement	Number	%
Yes	75	58.6%
No	53	41.4%
Total	128	

We next asked those offices that have a formal mission statement to tell us what their mission statement was. While only 75 institutions answered yes to the question above, 80 submitted a mission statement.

The following are typical of the Mission Statements we received:

> The XXXX Office of Technology Transfer promotes and supports the research enterprise at the University by creating relationships with the private sector to develop, protect, transfer and commercialize research results for the public benefit.

As a service provider, assist XXXX, its researchers, and its community partners with the development and promotion of biomedical innovations.

- Support the educational, research, and healthcare mission of the University by fostering creativity and innovation.
- Initiate and sustain cooperation and collaboration between the University and business and industry.
- Act as the University's intellectual property management and technology marketing arm.
- Advance healthcare-related economic development for our state and the nation.
- Support economic development through technology licensing.

It is the mission of the TTO to encourage broad practical application of System research for public benefit; to encourage and assist those associated with the System in the protection, licensing and commercialization of their discoveries; to ensure the equitable distribution of royalties and other monetary benefits resulting from the commercial application of intellectual property; and to see that commercialization activities benefit the research, education and outreach missions of the System into the future.

We searched all of the Mission Statements for keywords such as “value”, “income”, “revenue”, “financial return” and “maximize” that would speak to a focus on financial return.

We found Mission Statements such as:

Promoting the transfer of XXXX's life science & medical technologies for public use and benefit, while generating ***income*** to support campus research and education.

Our mission is to help facilitate scientific research at the Institute, promote transfer of Institute basic research discoveries to the marketplace for the public benefit, and generate ***revenue*** for further research.

- To facilitate the movement of Institute's inventions from research to application.
- To create ***value*** in the inventions by protecting them with patents and ensuring Institute’s ownership rights.
- To commercialize Institute's intellectual property in accordance with Institute’s mission and external granting agency guidelines (NIH, NSF, HHMI).

- To generate ***revenue*** for Institute, its inventors and its continued research through commercial licensing.
- To facilitate development of the local Biotechnology Industry and economy.

(emphasis added in each case)

The term *financial return* did not occur in any of the mission statements, and the words *maximum* and *maximize* each occurred only once, in the following two mission statements which were the only ones that seemed to establish maximizing financial value and return as the mission of the office.

> To ***maximize*** the ***value*** of XXXX's intellectual assets through the creation of novel and effective models for commercializing technology.

> The essential mission of the Office of Technology Transfer is twofold:
> (1) to promote the timely transfer of commercially valuable knowledge and inventions developed in the University to the businesses most capable of reducing them to practice and benefiting the economy of XXXX and the nation, and
> (2) to return ***maximum value*** for such commercialization to the inventor/s and to the University in support of its continuing research enterprise, in a manner which upholds sound ethical, legal, and academic standards. The value of technology licensing for the University includes its benefits in providing incentive to faculty for research and invention as well as the dollars received for financing continuing University research activity.

(emphasis added in each case)

k) Incentive Compensation

The final section of questions concerned incentive compensation. We first asked whether any personnel in the office receive incentive compensation. The results are shown in Table 16. Clearly only a minority of personnel receive bonuses.

Table 16 Offices Where Some Personnel Receive a Bonus

Do Some Personnel Receive Bonus	Number	%
Yes	22	17.2%
No	109	85.2%
Total	131	

Next we asked how many personnel in the office receive bonuses and compared the answer with the reported number of staff. The results are shown in Table 17. Clearly, in the relatively small number of offices that offer bonuses, bonuses tend to be offered broadly within the office.

Table 17 Availability of Bonuses within the Office

Number Receiving Bonus	Number	%
All	9	40.9%
More than the Professional Staff	3	13.6%
All Professional Staff	2	9.1%
Fewer than all Professional Staff	2	9.1%
One	6	27.3%
Total	22	

Next we asked how the bonuses were calculated. First we asked whether they were calculated based on office performance, individual performance or a combination of the two. The results are shown in Table 18. Clearly, the most prevalent practice is to incentivize a combination of total office performance and individual performance.

Table 18 Basis for Computation of Bonuses

Calculation Basis	Number	%
Individual performance	2	8.7%
Office performance	4	17.4%
Combination of office + individual	17	73.9%
Total	23	

Finally, we asked the bases on which bonuses are calculated. We asked whether five specific factors were taken into account in calculating bonuses, and in addition allowed respondents to identify one of more "other" factors. There was no limit to the number of factors that respondents could identify.

To analyze the data, we first reviewed what was entered in the "other" column, and entered the count of the number of specific factors that respondents identified.

Twenty one of the 22 respondents who reported that they had an incentive compensation plan identified the factors taken into account in computing incentive compensation. The 21 respondents reported 81 factors that were taken into account. A statistical analysis of the responses is shown in Table 19. Both the mean and the median Incentive Compensation Plans took into account 4 factors, though several only took into account one factor and one plan took into account 8 factors.

Table 19 Number Of Factors Taken Into Account In Calculating Incentive Compensation

Measure	Value
Mean	3.90
Median	4.00
Std Dev	2.57
Min	1.00
Max	8.00

As shown in Table 20, the most common factor taken into account in computing Incentive Compensation was "Other", followed by Total Income and Transactions Completed, followed by Disclosures Received.

Table 20 Factors Taken into Account in Awarding Incentive Compensation

Factor	Number	%
Other	18	22.2%
Total income	14	17.3%
Transactions completed	14	17.3%
Disclosures received	10	12.3%
Operating surplus	9	11.1%
Faculty satisfaction	9	11.1%
Start-ups formed	7	8.6%
Total	81	

The "Other" category included the following, several of which were cited by multiple respondents:

- Beneficial products and services introduced to society
- Community Service
- Exclusive licenses
- Faculty education activities
- New revenue
- Overall university financial performance
- Performance against specific targets
- Regional economic impact

Only two of these factors – Total Income and Operating Surplus – are financial return oriented and account for 28.4% of the factors cited, while the remaining 10 are oriented to broader measures of technology transfer performance.

5) Discussion

Our methodology was designed to make four independent determinations of the behavior of technology transfer in an institution through three independent sets of questions:

- How is the office financed?
- What drives the office – i.e., what behavior is the office actually demonstrating?
- What is the official mission of the office – i.e., what behavior has the institution told the office it wants from it?
- What are the office's incentives based on – i.e., what behavior does the institution really want and is prepared to pay extra for?

The results of these four independent determinations were consistent in demonstrating that financial return is not the major factor in technology transfer organization and behavior, as is often posited. In addition, we were able to compare the behavior of the office with the results achieved.

The results of our determinations are summarized in Table 21 below

Table 21 Summary of Estimates of Extent that Behavior is Driven by Income

Area of Investigation	Extent Driven by Income
Operating Budget	20.30%
Drivers	11.50%

Incentive Compensation	5.60%
Mission Statement	2.30%
Average	9.90%

There is a very clear trend and conclusion to be drawn from these results, namely that the more visible the factor, the lower the frequency with which we found income to be a key factor.

The most formal way to make income important is to put it in the TTO's Mission Statement. While a surprisingly high percentage of TTO's had no formal mission statement, only 2 out of 80 institutions that did have a formal mission statement – 2.5% – mentioned income or revenue in their mission statement. This proportion falls to 1.6% of all institutions that responded to the question on mission statements.

In looking at incentive compensation, we found that fewer than 20% of institutions provided incentive compensation to their TTO's, and that among those that did, 28% of the factors taken into account in determining incentive compensation focused on financial return, with the remainder focused on broader, non-financial measures of performance. This means that only 5.6% of offices were incented based on financial performance.

In looking at actual behavior, we found that the most important drivers of technology transfer were faculty service and translation of research results. Only 11.5% of offices stated that maximizing revenue was the most important driver of technology transfer.

Finally, in looking at the sources of the TTO's operating budget, we found that 20.3% of offices raise between 50%-100% of their operating budgets from their license income, giving them an incentive to maximize income simply in order to stay in business.

We therefore conclude that from 2.3% to 20.3%, with an average of 9.9% of technology transfer activities are driven by financial considerations, with most activity being driven by broader objectives, such as translation of research results and service to the faculty.

These results are not surprising in light of the way technology transfer is organized in the US. Fewer than 15% of offices are organized as independent corporations. An independent

corporation can develop a culture that is quite distinct from that of the parent institution. Outside the US, particularly in the UK and in Australia, independent corporations tend to be the preferred model. The extreme example of this is Imperial Innovations, plc, the technology transfer arm of Imperial College, London, which is an independent corporation and is publicly traded on the Alternative Investment Market of the London Stock Exchange. Clearly, Imperial Innovations has a fiduciary responsibility to its shareholders to maximize its profits, and it can no longer hew to the university's charitable mission.

In looking at budgeting procedures, we found that most offices depend to some extent on the income the offices generate; however, institutions contribute some amount to the budget of most offices.

Finally, we confirmed an earlier study that for over half of institutions, technology transfer is actually a cost to the institution rather than a source of income and that only 16% of institutions **retain** enough of their income to reimburse all the costs of operating their offices of technology transfer, after sharing their income with various stakeholders, such as inventors, labs and the university. We predict that institutions which establish their offices of technology transfer in the expectation of a "big hit" are therefore likely to be disappointed; however, institutions which establish their offices with a broad set of goals will likely see their objectives realized.

We should conclude with a caveat. The above findings and conclusions should not be interpreted as implying that TTO's don't care about the financial terms of the license transactions they negotiate and will "give" the technology away. Far from it. Technology transfer offices have a strong sense of fairness and will fight hard to ensure that their institution shares fairly in the fruits of success if their technology is successful in the market place. Rather, our conclusions mean that income is not the primary motivator of offices; that technologies with smaller market potential will receive as much attention as those that serve large markets; that if there is a single, credible potential licensee interested in a technology, then the office will negotiate exclusively with that company rather than seeking additional licensees to create a competitive bidding situation; that junior faculty will receive as much attention as senior faculty; that non-financial, academic and social considerations will be taken into account in negotiating deals, and so forth.