NEW YORK STATE SCIENCE & TECHNOLOGY LAW CENTER
AT SYRACUSE UNIVERSITY COLLEGE OF LAW

Research Project for:

NYSTAR: Assessing the Success of Technology Transfer Offices

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Abstract

Over the past ten years, a number of research studies have found various factors to be associated with the success of university technology transfer offices (TTOs). (We will refer to these as the "past effectiveness factors."). These research studies have utilized a variety of qualitative and quantitative means to measure the success of TTOs.[1] Additional factors, hypothesized by the research team at the NYS Science & Technology Law Center at Syracuse University College of Law (NYS STLC @ SUCOL) have also been identified as potential factors that are associated with the success of TTOs. The objective of this research project is to test the degree of correlation between the past effectiveness factors and the new hypothesized effectiveness factors on the success of TTOs as measured by three sets of data collected by the Association of University Technology Managers (AUTM).[2]

To test the degree of correlation between the past effectiveness factors and the hypothesized effectiveness factors, and the success of TTOs we used three sets of AUTM data to measure TTO success: (1) the ratio of licensing revenue to research expenditures; (2) the ratio of number of licenses and options to research expenditures; and (3) the number of startup companies per research expenditures. The decision to use research expenditures as the common denominator of these measures was based on the widely accepted premise that licensing revenue, number of licenses, and number of startups is directly proportional to the amount of research expenditures. That is, the higher the research expenditures, the higher the licensing revenue, the higher the number of licenses, and the higher the number of startups. By using research expenditures as the common denominator we are able to isolate the influence of research expenditures from other factors affecting the success of TTOs.

Another TTO characteristic that is widely accepted as affecting TTO licensing revenue, number of licenses and number of startups is whether or not the TTO is

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[1] Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* 13 (Rensselaer Polytechnic Inst. Working Papers on Econ., Working Paper No. 0609, 2006).

[2] AUTM 2007 U.S. Licensing Activity Survey, http://www.autm.net/Content/NavigationMenu/Surveys/LicensingSurveysAUTM/FY2007LicensingActivitySurvey/AUTMUSLS07FINAL.pdf

associated with a medical research hospital. Because our research focus is on TTOs that are not associated with medical research hospitals, we used only these TTOs in our study.[3] We first calculated a score for each TTO on each of the three ratio measures of success. We then summed the scores for each of the three measures of success to develop a composite list of TTOs ranging from the most successful to the least successful.[4]

The TTOs were scored from 1 (lowest) to 5 (highest) with respect to the past effectiveness factors and the hypothesized effectiveness factors. The past effectiveness factors include: (1) the number of TTO full-time employees, (2) incubator support, (3) industry experience, (4) marketing emphasis, and (5) inventor royalty incentive.[5] The hypothesized effectiveness factors include: (1) state funding dedicated to technology commercialization, (2) business expertise, and (3) the number of active technologies available for licensing at the TTO.

Once the data were collected, they were analyzed using SPSS version 15 for Windows.[6] Univariate analysis was performed using linear regression to test all TTO factors against composite efficiency scores as a dependant variable to determine which factors correlated most significantly with TTO success. Forward stepwise regression (removal parameter .05, entry parameter .10) was then used to determine the most significant multivariate model correlating to TTO success. In univariate models, full-time employees and business expertise demonstrated a significant positive correlation with TTO success, and royalty incentive demonstrated a significant negative correlation. The most significant multivariate model suggested that business expertise and state funding for technology commercialization were positively correlated to TTO success, while marketing emphasis was negatively correlated. Based on our findings, we

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[3] We suggest a follow-up research study to consider the correlation between the effectiveness factors and TTO success for only TTOs that are affiliated with medical research hospitals.

[4] Like beauty, to some extent "success" may be in the eye of the beholder. We do not suggest that our ranking of TTO success is absolute. Our ranking is based solely on the three measures of success we have defined.

[5] Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* 13 (Rensselaer Polytechnic Inst. Working Papers on Econ., Working Paper No. 0609, 2006).

[6] SPSS Inc., Chicago, IL

conclude that the composite efficiency score is a reliable means to assess overall success in technology transfer, and that business expertise at the TTO and state support for technology commercialization are probably important factors contributing to the success of TTOs.

1 Introduction

Academic innovations are typically managed by university technology transfer offices (TTOs). Once intellectual property rights are secured, university inventions can be commercialized either by licensing to industry or launching a startup company to develop the technology. The purpose of this study is to test the effectiveness factors that prior studies have found to correlate significantly with success in university TTOs as well as the new hypothesized effectiveness factors identified by the New York State Science and Technology Law Center at the Syracuse University College of Law.[7]

2 TTO Composite Efficiency Score

Each TTO was ranked by three measures of success: licensing revenue per research dollar spent at the institution, total active licenses and options per research dollar spent at the institution, and startup companies affiliated with the institution per research dollar spent at the institution.[8] The three success measures for each institution were then summed to calculate a composite success measure score. The TTOs were ranked by their composite success score in order to determine the most and least effective TTOs according to the 2007 Association of University Technology Managers (AUTM) Licensing Activity Survey.[9] The composite success score was used as the overall measure of success in our model.

2.1 Licensing Revenue per Research Dollar

Revenue payments from licensed university technologies likely represent the most commonly accepted measure of success for TTOs. In order to account for the probable

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[7] *See* Appendix A, Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* 13 (Rensselaer Polytechnic Inst. Working Papers on Econ., Working Paper No. 0609, 2006).

[8] These measures are based on data from the 2007 AUTM Survey.

[9] As noted earlier, we do not suggest that these three measures of success are the only measures of success or that our success rankings are absolute. The success rankings are based solely on the three measures we selected.

correlation between licensing revenue and research expenditures, we considered licensing revenue per research dollar to be a more relevant measure of TTO success than gross licensing revenue alone.

Table 1. TTO Licensing Revenue per Research Dollar

Name	Licensing Revenue per Research Dollar (x10^4)	Rank
Univ. of Akron	1245.976	1
Brigham Young Univ.	920.1581	2
Iowa State Univ.	728.4789	3
Univ. of Oregon	519.4277	4
Massachusetts Inst. of Technology (MIT)	506.2459	5
Univ. of Georgia	485.7558	6
Miami Univ.	301.0161	7
Univ. of Mississippi	277.2517	8
Carnegie Mellon Univ.	254.414	9
Rutgers, The State Univ. of NJ	254.2025	10
Clemson Univ.	233.2036	11
Kent State Univ.	220.7898	12
California Inst. of Technology	199.7834	13
Northeastern Univ.	193.002	14
Univ. of Alabama in Huntsville	171.8669	15
Kansas State Univ. Research Fdn.	153.7575	16
Arizona State Univ.	151.1719	17
Univ. of Texas at Austin	139.6672	18
Rensselaer Polytechnic Inst.	130.0658	19
Univ. of Toledo	125.106	20
North Dakota State Univ.	124.6129	21
Oregon State Univ.	113.5071	22
Univ. of Central Florida	109.9246	23
Virginia Tech Intellectual Properties, Inc.	109.4538	24
Univ. of Rhode Island	107.4645	25
Purdue Research Fdn.	107.4606	26
Stevens Inst. of Technology	99.63316	27
Florida Inst. of Technology	89.62564	28
Michigan Technological Univ.	75.16127	29
Washington State Univ. Research Fdn.	74.25447	30
Colorado State Univ.	72.96848	31
Univ. of North Carolina at Greensboro	59.87901	32
Louisiana Tech Univ.	49.90823	33
Rice Univ.	47.29229	34
Idaho Research Fdn., Inc.	47.14291	35
JHU Applied Physics Laboratory	43.69567	36
Georgia Inst. of Technology	40.41347	37
Auburn Univ.	39.36699	38
Univ. of Maryland, College Park	36.45104	39

Utah State Univ.	35.56861	40
Univ. of Arkansas, Fayetteville	35.54253	41
New Jersey Inst. of Technology	35.51337	42
Lehigh Univ.	32.98763	43
Univ. of Kansas	26.06321	44
Univ. of North Carolina, Charlotte	25.72412	45
Florida Atlantic Univ.	23.09749	46
Univ. of Delaware	22.42691	47
Mississippi State Univ.	20.0773	48
Univ. of Alabama	18.9069	49
Univ. of New Hampshire	18.51775	50
Univ. of Maryland Biotechnology Inst.	17.16051	51
Univ. of Maryland, Baltimore County	16.03034	52
Montana State Univ.	14.903	53
Univ. of Dayton Research Inst.	10.70545	54
George Mason Univ.	10.28135	55
Univ. of Notre Dame	10.12759	56
Univ. of Northern Iowa	9.43449	57
New Mexico State Univ.	6.74717	58
Univ. of Nevada at Las Vegas	2.52533	59
College of William & Mary	0.463092	60
Univ. of Montana	0.099969	61
Portland State Univ.	0	62
Univ. of West Florida Research Fdn.	0	62
Duquesne Univ.	0	62
Bowling Green State Univ.	0	62

2.2 Active Licenses and Options per Research Dollar

While licensing revenue is the most obvious measure of TTO success, revenue received typically depends upon commercial success of the university's technology in the hands of industry. In order to provide a more complete measure of TTO success independent of the profitability of its technologies, we also evaluated the total number of active licenses and options negotiated by a TTO, evaluated on a per research dollar basis.

Table 2. TTO Active Licenses and Options per Research Dollar

Name	Licenses and Options per Research Dollar ($x10^7$)	Rank
Brigham Young Univ.	75.6	1
Iowa State Univ.	24.0	2
Univ. of Georgia	21.2	3
North Dakota State Univ.	15.9	4
Univ. of Toledo	14.1	5
Michigan Technological Univ.	12.7	6
Montana State Univ.	12.1	7
Univ. of North Carolina, Charlotte	10.8	8
Kent State Univ.	10.7	9
Purdue Research Fdn.	9.41	10
Washington State Univ. Research Fdn.	9.39	11
Carnegie Mellon Univ.	9.01	12
Univ. of Dayton Research Inst.	8.84	13
Univ. of Oregon	8.71	14
Oregon State Univ.	8.71	15
Virginia Tech Intellectual Properties, Inc.	8.63	16
New Jersey Inst. of Technology	8.23	17
Rutgers, The State Univ. of NJ	7.93	18
Univ. of Maryland Biotechnology Inst.	7.77	19
Rice Univ.	7.28	20
Rensselaer Polytechnic Inst.	7.13	21
Univ. of Maryland, College Park	7.12	22
Univ. of New Hampshire	6.94	23
Massachusetts Inst. of Technology (MIT)	6.90	24
Univ. of Akron	6.69	25
Stevens Inst. of Technology	6.13	26
Georgia Inst. of Technology	5.80	27
Idaho Research Fdn., Inc.	5.47	28
Northeastern Univ.	5.34	29
Kansas State Univ. Research Fdn.	5.06	30

Louisiana Tech Univ.	4.94	31
Univ. of Maryland, Baltimore County	4.48	32
Utah State Univ.	4.42	33
Univ. of Kansas	4.19	34
Univ. of Central Florida	3.85	35
Univ. of Arkansas, Fayetteville	3.52	36
Univ. of Mississippi	3.50	37
Auburn Univ.	3.41	38
Univ. of Montana	3.38	39
Univ. of Texas at Austin	3.34	40
California Inst. of Technology	2.94	41
Florida Atlantic Univ.	2.76	42
Clemson Univ.	2.55	43
Univ. of North Carolina at Greensboro	2.46	44
Mississippi State Univ.	2.33	45
Arizona State Univ.	1.92	46
Lehigh Univ.	1.90	47
Colorado State Univ.	1.82	48
Univ. of Delaware	1.79	49
Univ. of West Florida Research Fdn.	1.74	50
Univ. of Northern Iowa	1.72	51
George Mason Univ.	1.63	52
Univ. of Notre Dame	1.57	53
Univ. of Rhode Island	1.39	54
JHU Applied Physics Laboratory	1.35	55
Miami Univ.	1.29	56
Florida Inst. of Technology	1.28	57
New Mexico State Univ.	0.971	58
Duquesne Univ.	0.909	59
Univ. of Alabama	0.882	60
Portland State Univ.	0.799	61
Univ. of Alabama in Huntsville	0.769	62
College of William & Mary	0.695	63
Univ. of Nevada at Las Vegas	0.286	64
Bowling Green State Univ.	0	65

2.3 Startups per Research Dollar

An alternative to licensing university technologies to industry is to build a startup business around the technology, whereby the university typically contributes more actively to commercialization than in a licensing arrangement with an industry partner. The number of new startups per research dollar was evaluated in order to reflect TTO success in commercializing technologies that result in university business equity rather than licensing revenue.

Table 3: TTO Startups per Research Dollar

Name	Startups per Research Dollar ($x10^8$)	Rank
Brigham Young Univ.	22.9	1
Louisiana Tech Univ.	14.1	2
Stevens Inst. of Technology	10.2	3
Michigan Technological Univ.	5.3	4
Kent State Univ.	5.10	5
Univ. of Alabama	5.04	6
Florida Atlantic Univ.	5.03	7
Rice Univ.	4.94	8
Univ. of Akron	3.94	9
Univ. of Toledo	3.81	10
Northeastern Univ.	3.56	11
Univ. of North Carolina at Greensboro	3.51	12
Carnegie Mellon Univ.	3.5	13
Univ. of North Carolina, Charlotte	3.36	14
Univ. of Oregon	3.04	15
George Mason Univ.	2.96	16
Univ. of Central Florida	2.69	17
Portland State Univ.	2.66	18
Univ. of Arkansas, Fayetteville	2.64	19
Clemson Univ.	2.47	20
California Inst. of Technology	2.40	21
College of William & Mary	2.32	22
Univ. of Maryland, College Park	2.18	23
Utah State Univ.	2.17	24
Lehigh Univ.	2.11	25
Colorado State Univ.	2.03	26
Massachusetts Inst. of Technology (MIT)	1.97	27
Univ. of Delaware	1.92	28
Idaho Research Fdn., Inc.	1.89	29
Univ. of Mississippi	1.84	30

Georgia Inst. of Technology	1.84	31
Arizona State Univ.	1.83	32
Purdue Research Fdn.	1.69	33
Univ. of Montana	1.61	34
Oregon State Univ.	1.58	35
Univ. of Kansas	1.55	36
Univ. of Alabama in Huntsville	1.54	37
Rensselaer Polytechnic Inst.	1.52	38
Mississippi State Univ.	1.45	39
Auburn Univ.	1.42	40
Univ. of Dayton Research Inst.	1.34	41
Rutgers, The State Univ. of NJ	1.28	42
Virginia Tech Intellectual Properties, Inc.	1.10	43
Kansas State Univ. Research Fdn.	1.08	44
Univ. of Georgia	0.902	45
Iowa State Univ.	0.825	46
New Mexico State Univ.	0.809	47
Univ. of Texas at Austin	0.63	48
JHU Applied Physics Laboratory	0.135	49
North Dakota State Univ.	0	50
Montana State Univ.	0	50
Washington State Univ. Research Fdn.	0	50
New Jersey Inst. of Technology	0	50
Univ. of Maryland Biotechnology Inst.	0	50
Univ. of New Hampshire	0	50
Univ. of Maryland, Baltimore County	0	50
Univ. of West Florida Research Fdn.	0	50
Univ. of Northern Iowa	0	50
Univ. of Notre Dame	0	50
Univ. of Rhode Island	0	50
Miami Univ.	0	50
Florida Inst. of Technology	0	50
Duquesne Univ.	0	50
Univ. of Nevada at Las Vegas	0	50
Bowling Green State Univ.	0	50

2.4 Composite Efficiency Score

After ranking TTOs on the three above measures of success, the ranks were summed to create a composite efficiency score, with each of the three component measures weighed equally in the composite. After creating a composite score that reflects licensing revenue, licensing activity, and startup businesses, it was possible to compare TTO efficiency in a manner that accounts for multiple modes of technology commercialization.

Table 4: TTO Composite Efficiency Scores

Name	License Revenue Rank	License and Option Rank	Startup Rank	Composite Score	Composite Rank
Brigham Young Univ.	2	1	1	4	1
Kent State Univ.	12	9	5	26	2
Univ. of Oregon	4	14	15	33	3
Carnegie Mellon Univ.	9	12	13	34	4
Univ. of Akron	1	25	9	35	5
Univ. of Toledo	20	5	10	35	5
Michigan Technological Univ.	29	6	4	39	7
Iowa State Univ.	3	2	46	51	8
Northeastern Univ.	14	29	11	54	9
Univ. of Georgia	6	3	45	54	9
Stevens Inst. of Technology	27	26	3	56	11
Massachusetts Inst. of Technology (MIT)	5	24	27	56	11
Rice Univ.	34	20	8	62	13
Louisiana Tech Univ.	33	31	2	66	14
Univ. of North Carolina, Charlotte	45	8	14	67	15
Purdue Research Fdn.	26	10	33	69	16
Rutgers, The State Univ. of NJ	10	18	42	70	17
Oregon State Univ.	22	15	35	72	18
Clemson Univ.	11	43	20	74	19
Univ. of Central Florida	23	35	17	75	20
California Inst. of Technology	13	41	21	75	20
Univ. of Mississippi	8	37	30	75	20
North Dakota State Univ.	21	4	50	75	20
Rensselaer Polytechnic Inst.	19	21	38	78	24
Virginia Tech Intellectual Properties, Inc.	24	16	43	83	25
Univ. of Maryland, College Park	39	22	23	84	26
Univ. of North Carolina at Greensboro	32	44	12	88	27
Kansas State Univ. Research Fdn.	16	30	44	90	28
Washington State Univ. Research Fdn.	30	11	50	91	29
Idaho Research Fdn., Inc.	35	28	29	92	30
Florida Atlantic Univ.	46	42	7	95	31
Georgia Inst. of Technology	37	27	31	95	31
Arizona State Univ.	17	46	32	95	31
Univ. of Arkansas, Fayetteville	41	36	19	96	34
Utah State Univ.	40	33	24	97	35
Colorado State Univ.	31	48	26	105	36
Univ. of Texas at Austin	18	40	48	106	37
Univ. of Dayton Research Inst.	54	13	41	108	38

New Jersey Inst. of Technology	42	17	50	109	39
Montana State Univ.	53	7	50	110	40
Miami Univ.	7	56	50	113	41
Univ. of Kansas	44	34	36	114	42
Univ. of Alabama in Huntsville	15	62	37	114	42
Univ. of Alabama	49	60	6	115	44
Lehigh Univ.	43	47	25	115	44
Auburn Univ.	38	38	40	116	46
Univ. of Maryland Biotechnology Inst.	51	19	50	120	47
George Mason Univ.	55	52	16	123	48
Univ. of New Hampshire	50	23	50	123	48
Univ. of Delaware	47	49	28	124	50
Univ. of Rhode Island	25	54	50	129	51
Mississippi State Univ.	48	45	39	132	52
Univ. of Montana	61	39	34	134	53
Univ. of Maryland, Baltimore County	52	32	50	134	53
Florida Inst. of Technology	28	57	50	135	55
JHU Applied Physics Laboratory	36	55	49	140	56
Portland State Univ.	62	61	18	141	57
College of William & Mary	60	63	22	145	58
Univ. of Northern Iowa	57	51	50	158	59
Univ. of Notre Dame	56	53	50	159	60
Univ. of West Florida Research Fdn.	62	50	50	162	61
New Mexico State Univ.	58	58	47	163	62
Duquesne Univ.	62	59	50	171	63
Univ. of Nevada at Las Vegas	59	64	50	173	64
Bowling Green State Univ.	62	65	50	177	65

3 Factors Associated with Effectiveness of TTOs

3.1 Past Effectiveness Factors

As noted earlier, there have been a number of research studies published in the last ten years that have sought to correlate various quantitative and qualitative effectiveness factors with the success of TTOs. The quantitative effectiveness factors set forth below were chosen because they could be measured using a 1 to 5 ranking. We obtained the data necessary to score these effectiveness factors from each TTO's webpage found on the internet.

3.1.1 Full Time Employees Working at the TTO

Past studies have found that the number of full time employees working at a TTO is a factor that significantly correlates with the effectiveness of TTOs.[10] In most TTOs identified by AUTM, full time employees at the TTOs most often consist of a TTO director, one to three licensing associates, a docketing person, and one or two administrative assistants to support the office.[11] Some other offices also include persons dedicated to marketing and business development.

The following definitions provide a means to rank the TTO offices based on a number of employment considerations such as the number of employees, the specialized tasks of employees and the experience of employees.

Number of Full Time Employees at TTO Rubric

1	2	3	4	5
0-3 full time employees Factors may include the roles of those employees as well (ie: 1 licensing associate and 2 or more support staff)	4-7 full time employees The employees' roles may include involvement in start-up and licensing activity and there is only one person focused on budget/administrative task.	8-11 full time employees There is extensive licensing emphasis, start up support, docketing managers	12-15 full time employees Additional support to handle an active docket of technologies	15 or more full time employees Employees have specialized individual roles dedicated to specific functions in the commercialization process

It is expected that results from using this factor to assess TTO success would show that the larger, the more specialized and the more experienced the TTO staff, the greater the number of invention disclosures and the higher the level of TTO activity at the University. We expect there will be a correlation between the employment characteristics of the TTO and the ranking of the TTO in the overall composite success score based upon the AUTM data.

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[10] Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* 13 (Rensselaer Polytechnic Inst. Working Papers on Econ., Working Paper No. 0609, 2006).

[11] *See* AUTM rankings.

3.1.2 Incubator Support for the TTO

Incubators are a business support process designed to accelerate the development of seed-stage companies. Entrepreneurs are provided with a range of targeted resources and services at an incubator site. The services are usually developed or orchestrated by incubator management and can be offered both within the incubator itself and through a network of external contacts. An incubator's primary goal is to produce firms that will leave the program as financially viable and freestanding business entities.

For the purposes of gauging the correlation between the overall performance of technology transfer offices and the availability of business incubation, this report scores each office as outlined in the rubric below:

Incubator Support at the TTO Rubric

1	2	3	4	5
No incubator or equivalent support available	Minimal related resources available	On-site incubation available	Well-established incubator, but may lack resources	Business incubation with full range of targeted services

Here, a "Perfect 5" incubator has a range of targeted services, typically benefiting from a large network of resident, affiliated, and graduate companies. A business incubator with a well-established reputation, but limited by resources; history; focus; industry expertise, support, or experience may get a lower ranking. Additionally, incubators with minimal business incubation or support services will get even lower rankings.

It is hypothesized that a high ranking for the incubator factor of the TTO will correlate with a high ranking of the TTO in the composite ranking based upon the AUTM data.

3.1.3 Industry Experience and Firm Linkage at the TTO

Industry experience and firm linkages is a factor defined by the degree of connection between the actual technology transfer professional(s) employed at the university TTO and industry players (ie: potential licensees, research sponsors). Past research on TTO effectiveness has identified "firm linkages," or other networking, professional ties, and former employment in industry, as related to the overall effectiveness of a TTO.

The rubric below considers whether a TTO employs professionals that have prior industry experience and the length of such experience. Where necessary, an additional point can be added for the number of employees employed with industry experience. For example, if a TTO employs two employees with 2-4 years of industry experience, it would be discretionary but appropriate to increase the TTOs rank. Also, when posed with deciding how many years an employee has been employed, the rankings require rounding up by the nearest half year, e.g., if an employee has worked at the TTO for 4 years and 6 months, this is a 4, but if the employee has worked at the TTO for 4 years and 3 months, this remains a 3.

Industry Experience and Firm Linkages at the TTO Rubric

1	2	3	4	5
Experience: Never worked in industry	Experience: 1 year or less	Experience: 2-4 years	Experience: 5-9 years;	10+ years of industry experience

Here, a perfect "5" is a TTO with an employee who has more than 10 years of industry experience prior to joining the TTO. For each of the descending ranks, the number of years of experience are noted above and correspond with the assigned rank.

If this factor is determinative, a TTO employing professionals with prior industry experience should have greater success in commercializing technologies because they are experienced with industry standards, procedures, tactics and methodologies. Additionally, industry experience lends itself to consider different viewpoints, appeal to certain interests, and use prior relationships to network and build new business relationships, which all assist with advancing the commercialization and transfer of technologies into the marketplace. We expect the number of employees at a TTO with past industry experience will likely correlate to a higher ranking of the TTO in the composite success ranking based upon the AUTM data.

3.1.4 Marketing Emphasis at the TTO

The strategies a TTO uses to promote, advertise, and license its technologies largely influence its success. Past research on TTO success suggests that one reason some TTOs are less successful than others is lack of sufficient marketing experience.[12] In this context, marketing applies to the methods, strategies, and promotion techniques that the TTO uses to disseminate information about its technology, by both pushing the technology and pulling or attracting attention to the technology. When a TTO is deficient in drawing investors or other potential business relationships, it may be a result of its inexperience or outright failure to effectively "promote" or "advertise" the technology.

Here, this factor examines the methods and other strategies used by the TTO to effectively commercialize by employing marketing techniques. The areas of marketing emphasis that are considered, include: organization of website and its design; campaigns to promote certain technologies, i.e., organized events or other publicity garnering sponsorships; descriptions of technologies; obvious availability of TTO professionals to discuss the technology (i.e., is there a prompt on the website to email or call for more information), and use of "selling features" (i.e., notoriety of the inventor, reputation of the university, etc.).

[12] AUTM *supra* note 2.

Marketing Emphasis at the TTO Rubric

1	2	3	4	5
Undeveloped or No Website	Disorganized and Scattered	Slightly More Confusion	Slight Confusion	**Easy**
None	Several clicks	4+ clicks	2-3 clicks to find contact	**Accessible**; 1 click/home page
None	Vague Descriptions	Basic Description	Descriptive, slightly persuasive	**Presentation**; Detailed, easy to locate
None	Limited Contact Information	Contact Information Available	No overt invitation but encouraged inquiry	**Promotion** Scheduled event; draw to call

A perfect "5" ranking would require that the TTO's website is easy to navigate, technologies are easily accessible and contact information is readily available; opportunities to attend events or visit the TTO for in-person discussions are encouraged and welcomed to promote the technology; and the TTO's presentation of the technology includes a description pertaining to its unique attributes and highlights other advantages. The descending ranks take the same four principles: ease, accessibility, presentation and promotion, and take into account inefficiencies and other impediments that make the marketing of the technologies less appealing and less effective in attracting the attention of interested parties. This factor is extremely subjective; however, this rubric is fairly self-explanatory when looking at a model website. That is, it is easy to spot that marketing which is and that which is not effective.

It is hypothesized that a higher ranking for marketing emphasis at a TTO will correlate with a higher ranking of the TTO in the composite ranking based upon the AUTM data.

3.1.5 Royalty Incentives

This factor considers the extent to which a university's royalty distribution formula favors faculty-inventors. Past research on effectiveness factors have identified a number of studies showing that the higher the percentage of royalties a faculty member may receive, the more likely faculty are to report inventions to TTO offices and the more effective a TTO will be at commercializing new technologies.[13] But, as past research also points out, other studies have shown that a more favorable distribution formula will lead faculty members to pursue less start-up ventures.[14] Since all royalty distribution formulas represent a balancing of interests between the entities receiving the compensation, this factor is used to determine which royalty formulas are associated with the highest level of TTO success and thus are correlated with the most appropriate, balanced distribution formulas.

In a typical royalty distribution formula, universities will split royalty revenues in varying proportions between the faculty-inventor, the faculty-inventor's academic department, the university, and occasionally the inventor's research budget.[15] In nearly every case, universities will not distribute funds to faculty-inventors until after the university has recovered the costs it incurred to acquire and protect the intellectual property at issue.

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[13] *See, e.g.,* Albert Link & Donald Siegel, *Generating Science-Based Growth: An Econometric Analysis of the Impact of Organizational Incentives on University--Industry Technology Transfer*, 11 EUR. J. FIN. 169 (Issue 3, 2005) *noted in* Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* 13 (Rensselaer Polytechnic Inst. Working Papers on Econ., Working Paper No. 0609, 2006).

[14] Dante Di Gregorio & Scott Shane, *Why Do Some Universities Generate More Start-ups Than Others?*, 32 Res. Pol'y 209 (Issue 2, 2003) *noted in* Phan & Siegel at 8-9.

[15] *See, e.g.,* Science and Technology Ventures – Columbia University Policies, http://stv.columbia.edu/index.php?option=com_content&task=blogcategory&id=24&Itemid=43#a (last visited Mar. 27, 2009) (50% of income from invention goes to faculty-inventor on first $100,000 after 20% of net income is deducted to cover University's intellectual property expenses incurred on the technology with remaining 50% split between the university and funding the inventor's future research; Faculty-inventor receives 25% of net income above the first $100,000 and another 25% to fund future research while the university and the inventor's department receive the other 50%).

The definitions below reflect the initial inventor royalty share and the rankings are as follows[16]:

<u>Royalty Incentives at the TTO Rubric</u>

1	2	3	4	5
< 20%	20%-30%	31%-40%	41%-50%	> 50%

The rankings are based on percentages, as noted above. A clear demonstration of how this ranking works is to consider a formula where the inventor receives 50 percent of an initial share of the first $100,000 and 25 percent for revenues earned in excess of $100,000. In this example, the university would receive a "4" on this factor. We believe it is appropriate to only consider the initial revenue split (i.e. the 50 percent of the first $100,000 not the 25 percent of any amount over $100,000 in our example), because most patents rarely even become commercialized, and even fewer earn more than the initial amount specified in the formula. Although the inventor's share in this formula is received after the university recovers its costs, all universities face the same costs to obtain patents and the potential for litigation on each patent. Therefore, it is appropriate not to consider those costs in this factor since these costs are essentially fixed for all universities.

We expect our results from applying this factor to assess TTO success will likely show that higher royalty incentives to inventors at the university will lead to more active technologies available for licensing and, therefore, an increase in the number of licenses and licensing revenue at a TTO. Similarly, results may show that there will be a smaller number of start-up companies produced where royalty incentives would support more upfront licensing revenue out of an established licensee. The overall TTO ranking will probably be higher for universities with high scores on this factor, but this advantage may be offset by a lower rate of start-up formation.

[16] The royalty shares are rounded to the nearest whole number. For example, a inventor royalty share of 30.5 percent would be rounded up to 31 percent.

3.2 *New York State Science and Technology Law Center at the Syracuse University College of Law Hypothesized Effectiveness Factors*

Along with the past effectiveness factors identified in Section 4.1 of this report, additional factors may gauge the effectiveness and success of TTOs. The following factors were identified by our group and are considered in this study.

3.2.1 State funding

In 2005, the total state investment in technology commercialization was over $2.8 billion.[17] While virtually every state utilizes public funds to support technology commercialization, widely different means are employed. The three most common forms of public support include: (1) direct research support, (2) technology maturation and seed funding, and (3) publicly financed venture capital.

Using data from a 2005 report published by the National Centers of Excellence, entitled "State Technology Commercialization and Development Programs: A Survey of the States,"[18] a figure for each state's funding was determined and then ranked according to the following rubric:

State Funding and Support in the TTO's State Rubric

1	2	3	4	5
$0-50M	>$50-100M	>$100M-150M	>$150-200M	$200M+

By whatever means selected, we expect that there is a correlation between the amount of funds available from state support, and the effectiveness of a TTO in that state because financial support is critical to the development and commercialization of new technologies.

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[17] G. Michael Alder, *State Technology Development and Commercialization Programs: A Survey of the States*, http://www.nationalcoe.org/documents/NCOE-study2.doc.

[18] *Id.*

3.2.2 Business Expertise

Technology transfer offices mark a fine line between academic research and business development in the context of technology commercialization. This analysis sought to identify those offices that, apart from marketing efforts and incubation services, had personnel with demonstrated business expertise, and/or programs in the areas of finance, business development, and business-community outreach. While many TTOs have legal and scientific expertise, there may be less emphasis on business expertise. The business professionals may be a part of the TTO or another office at the university, developed to specifically focus on corporate relations, start-up company support, and other business-related aspects of technology commercialization.

For the purposes of gauging the correlation between the overall performance of each technology transfer office and its level of business expertise, this report scores each office as outlined in the rubric below:

Business Expertise Rubric

1	2	3	4	5
Insular focus on pure research.	Business development, etc., may be stated goal, but office staff lacks relevant experience outside of academia.	Business-development initiatives exist, but are largely indistinguishable from marketing efforts or on-site business incubation.	Full-time staff lacks MBA or equivalent, but intellectual capital from TTO experience is considerable.	MBA; aggressive business-development strategies are clearly articulated.

We expect results from using this factor to assess TTO success will likely show that business expertise at the TTO, will lead to more active technologies available for licensing, higher licensing revenues, and an increase in start-up companies given the emphasis and expertise in business and therefore, a higher TTO ranking in our study.

3.2.3 Number of Active Technologies

The number of active technologies is indicative of the TTOs revenue from existing technologies. The number of a TTO's active technologies was determined by counting the number of actual technologies listed on TTO websites. Although most

TTOs have more technologies at their disposal than are listed online, the TTO's opportunity to maximize marketing efforts and promote their technologies may indicate the success of a TTO. For example, looking at this factor will allow for a determination of whether a TTO is better-off emphasizing a broad range of technologies to appeal to the largest possible audience or whether it makes more sense to specifically target a narrow set of potential licensees. Below are the definitions used to scale the TTO based on the number of active technologies.

Number of Active Technologies at the TTO Rubric

1	2	3	4	5
1-2 active technologies showing little development or maintenance of technology	3-4 active technologies	5-9 active technologies	10-20 active technologies	20+ active technologies and/or well presented technology descriptions available

We expect results from using this factor to assess TTO success will likely show that a higher number of active technologies presented on a TTO website and presented in a complete and marketable format, the greater likelihood that the TTO will rank higher in our study.

4 Correlation Research Findings

Data for all factors potentially correlated to the composite efficiency score were collected, and analyzed using SPSS version 15 for Windows.[19] Univariate analyses were performed using linear regression to determine which factors were individually most strongly correlated to the composite efficiency score. Forward stepwise regression was then used to determine the most significant multivariate model of the composite efficiency score in order to determine which factors were correlated to TTO success when accounting for the presence of other factors.

19 SPSS Inc., Chicago, IL

4.1 Analysis

Data were collected for each variable at the TTOs reviewed in this paper, and are summarized below in Table 5. In order to determine which factors were correlated to TTO success as measured by our composite efficiency score, two separate methods were employed. Univariate analyses were used to identify factors that alone were correlated to TTO success, and forward stepwise regression was used to determine which factors combined to explain the greatest amount of variation in TTO success.

Table 5: TTO Factor Scores (. indicates missing observation)

NAME	COMP	FTE	INCUB	EXP	MKT	ROY	STATE	BIZ	TECH
Brigham Young Univ.	4	2	1	5	3	4	3	4	5
Kent State Univ.	26	1	3	2	4	3	2	2	5
Univ. of Oregon	33	2	4	3	2	3	4	2	1
Carnegie Mellon Univ.	34	2	3	5	5	5	5	5	1
Univ. of Akron	35	1	2	4	3	3	2	4	5
Univ. of Toledo	35	1	4	5	4	4	2	4	5
Mich. Tech. U	39	1	5	5	4	4	5	5	5
Iowa State Univ.	51	2	5	3	5	2	3	3	5
Northeastern Univ.	54	1	1	3	2	2	1	3	5
Univ. of Georgia	54	2	4	4	3	2	1	3	5
Stevens Inst. of Technology	56	1	3	2	3	3	1	2	5
Massachusetts Inst. of Technology	56	5	1	5	3	3	1	5	5
Rice Univ.	62	1	1	5	4	3	3	5	5
Louisiana Tech Univ.	66	1	4	3	3	3	1	3	5
Univ. of North Carolina,	67	1	5	3	2	4	1	3	1
Purdue Research Fdn.	69	2	5	5	4	3	4	5	5
Rutgers, The State Univ.	70	2	4	4	5	2	1	4	5
Oregon State Univ.	72	2	4	.	5	3	4	.	5
Clemson Univ.	74	1	4	.	1	3	4	.	5
Univ. of Central Florida	75	1	5	5	5	.	2	5	5
California Inst. of Tech	75	2	5	.	5	2	5	.	5
Univ. of Mississippi	75	1	3	.	3	2	1	5	5
North Dakota State Univ.	75	1	4	5	3	2	1	5	5
Rensselaer Polytechnic Inst.	78	2	4	.	3	3	1	5	5

Virginia Tech	83	2	4	.	4	4	1	.	5
Univ. of Maryland, College	84	1	5	1	2	4	1	.	5
Univ. of North Carolina	88	1	3	5	4	4	1	5	3
Kansas State Univ. Research	90	1	4	.	4	2	1	4	5
Washington State Univ. Research	91	2	1	5	5	5	1	5	5
Idaho Research Fdn., Inc	92	1	3	.	2	3	1	.	5
Florida Atlantic Univ.	95	1	2	.	4	5	2	5	5
Georgia Inst. of Technology	95	2	5	.	3	3	1	5	.
Arizona State Univ.	95	3	2	5	5	4	2	5	5
Univ. of Arkansas, Fayetteville	96	1	4	5	4	4	2	3	5
Utah State Univ.	97	2	5	5	5	4	3	4	5
Colorado State Univ.	105	1	3	5	4	3	2	4	5
Univ. of Texas at Austin	106	2	5	5	5	1	3	5	5
Univ. of Dayton Research	108	1	5	.	2	4	2	1	5
New Jersey Inst. of Tech	109	1	5	5	5	4	1	5	5
Montana State Univ.	110	1	5	.	3	.	1	.	5
Miami Univ.	113	1	2	1	1	3	2	1	.
Univ. of Alabama in Hunt	114	1	5	5	2	.	1	5	.
Univ. of Alabama	115	1	5	.	4	4	1	.	5
Lehigh Univ.	115	1	3	.	4	4	5	.	5
Auburn Univ.	116	2	5	5	4	4	1	5	5
Univ. of Maryland Biotech	120	1	2	4	4	4	1	3	5
George Mason Univ.	123	1	4	3	5	4	1	3	5
Univ. of New Hampshire	123	1	1	3	1	.	1	1	1
Univ. of Delaware	124	1	1	.	4	.	1	2	5
Univ. of Rhode Island	129	1	1	.	2	.	1	2	.
Mississippi State Univ.	132	1	3	4	5	3	1	4	5
Univ. of Montana	134	1	3	3	3	4	1	3	4
Univ. of Maryland, Balt.	134	1	1	2	3	5	1	.	5
Florida Inst. of Technology	135	1	.	.	3	2	2	.	4
JHU Applied Physics Lab.	140	2	4	5	5	5	1	3	5
Portland State Univ.	141	1	2	3	5	3	4	1	5
College of William & Mary	145	1	3	5	5	5	1	2	4
Univ. of Northern Iowa	158	1	2	4	4	5	3	5	4
Univ. of Notre Dame	159	1	2	4	4	4	4	1	5

Univ. of West Florida Res.	162	1	.	.	1	.	2	.	.
New Mexico State Univ.	163	1	1	.	2	4	1	1	.
Duquesne Univ.	171	1	1	.	2	5	5	1	3
Univ. of Nevada at Las Vegas	173	1	3	.	4	5	1	2	5
Bowling Green State Univ	177	1	3	.	5	5	2	3	3

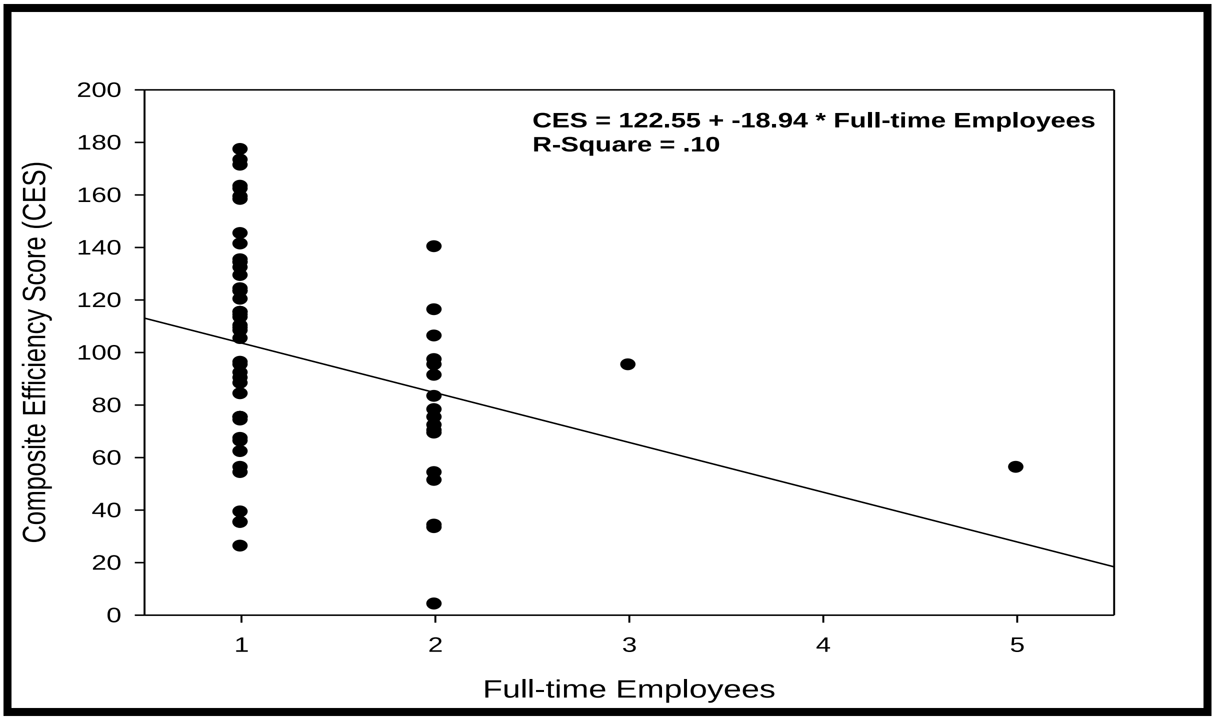
4.2 Univariate Analyses

Simple linear regressions were performed for the composite efficiency score in order to compare our findings to relationships suggested by prior research, and to determine which factors contribute to overall TTO success as measured by our composite. Because the composite score was calculated by summing ranks, a low composite score indicated a high level of success, and factors that contributed positively to TTO success were identified by negative regression coefficients (beta values). In summary, TTO success was found to be positively correlated with the number of full time employees factor and the business expertise factor, but was negatively correlated with the royalty incentive factor.

4.2.1 Full-Time Employees

Consistent with our expectations based upon prior studies, the number of full-time employees at a TTO was strongly and positively associated with TTO success. The relationship was highly significant (alpha=.05, p=.01), and demonstrated a negative relationship between the number of full-time employees and the composite efficiency score (beta=-.318). Approximately 10 percent of the variation in composite score was explained by the relationship with the number of full time employees (R-square=.101). The results are plotted below in Figure 1, and summary F-statistics can be found in Appendix 8.2.

Figure 1: Full-Time Employees vs. TTO Success



4.2.2 Incubator Support

Contrary to our expectations, no statistically significant association was found between incubator support and TTO success (p=.11). Summary F-statistics can be found in Appendix 8.3.

4.2.3 Industry Experience

Contrary to our expectations, no statistically significant association was found between industry experience and TTO success (p=.84). Summary F-statistics can be found in Appendix 8.4.

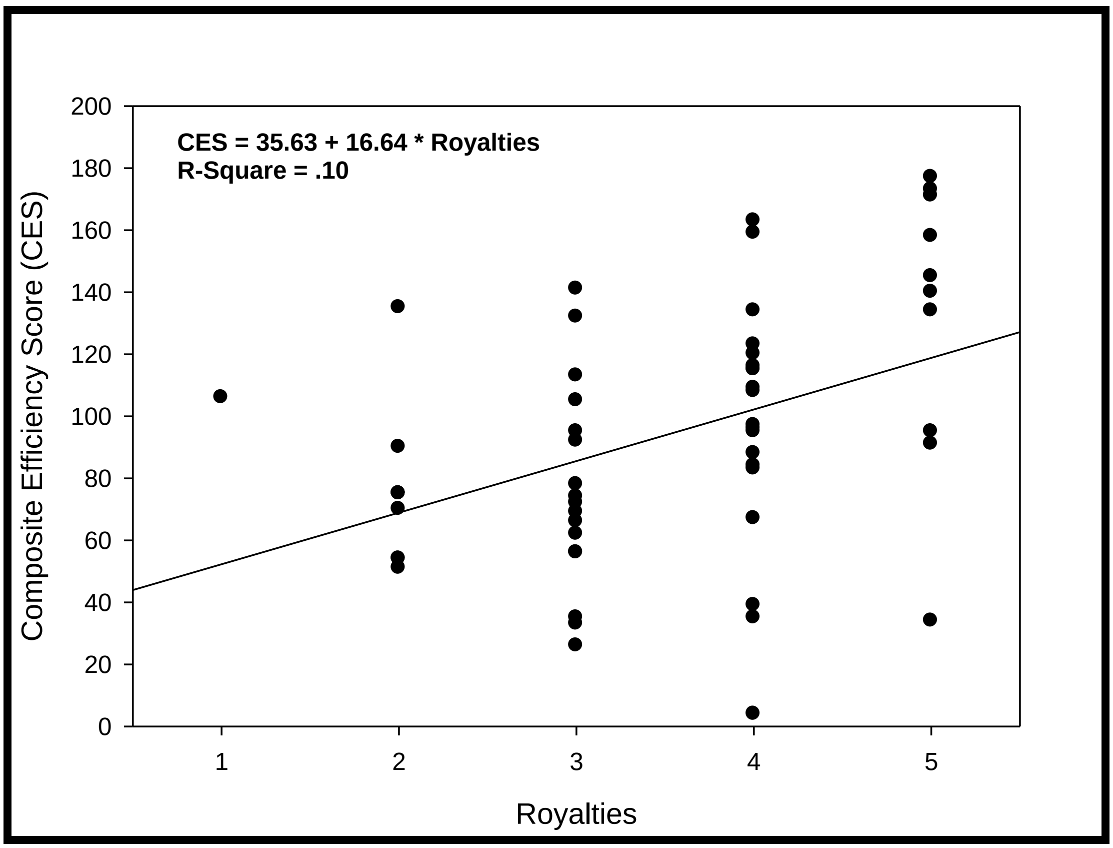
4.2.4 Marketing Emphasis

Contrary to our expectations, no statistically significant association was found between marketing emphasis and TTO success (p=.97). Summary F-statistics can be found in Appendix 8.5.

4.2.5 Royalty Incentive

Contrary to our expectations, an inventor's initial royalty percentage was negatively associated with TTO success. The correlation was highly significant (alpha=.05, p=.001), and indicated a positive relationship between composite score and royalty incentive (beta=.415). The results are plotted below in Figure 2, and summary F-statistics can be found in Appendix 8.6.

Figure 2: Royalty Percentage v. TTO Success



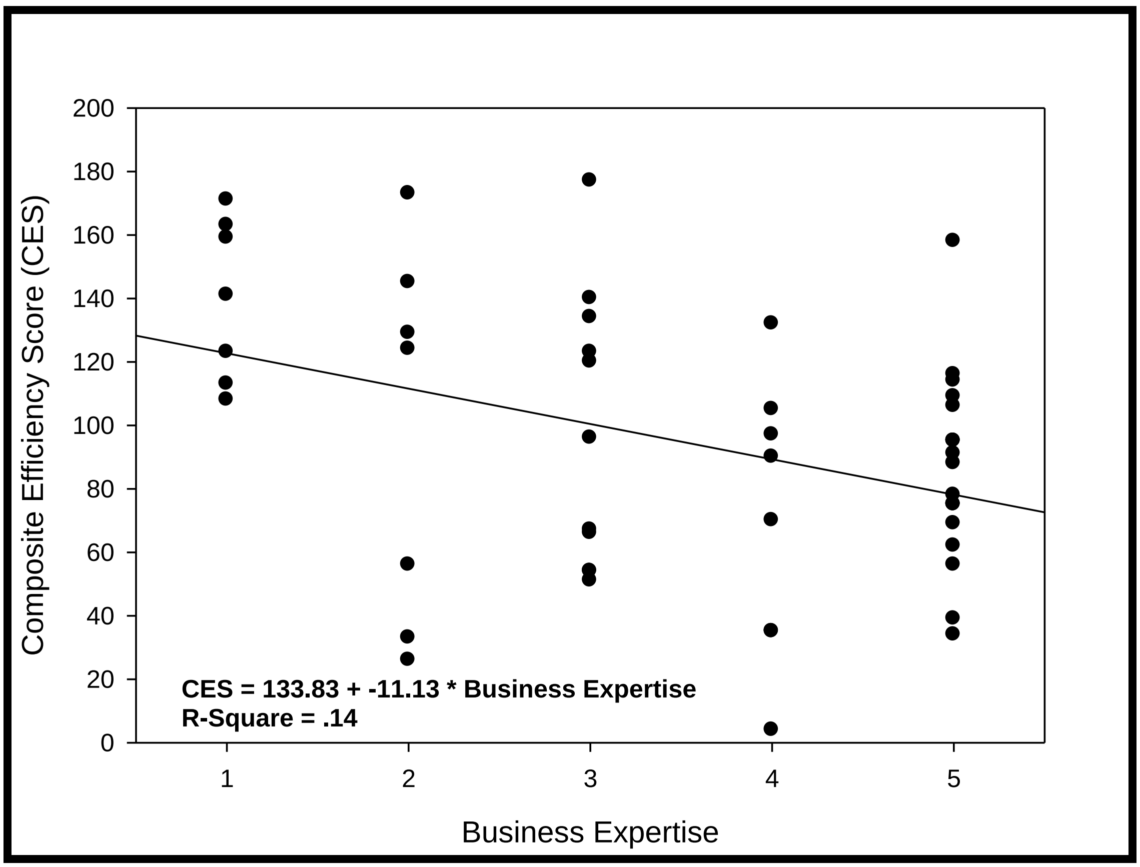
4.2.6 State Funding

Contrary to our expectations, no statistically significant relationship between state funding and TTO success was found (p=.23). Summary F-statistics can be found in Appendix 8.7.

4.2.7 Business experience

This study found a strong positive association between business expertise at TTOs and TTO success. The relationship was highly significant (alpha=.05, p=.005), and demonstrated a negative correlation between business experience and composite efficiency score (beta=-.380). Approximately 14.5 percent of the variation in composite score was explained by variation in business expertise. The results are plotted below in Figure 3, and summary F-statistics can be found in Appendix 8.8.

Figure 3: Business Expertise vs. TTO Success



4.2.8 Number of Active Technologies

Contrary to our expectations, no statistically significant relationship between the number of active technologies and TTO success was found (p=.90). Summary F-statistics can be found in Appendix 8.9.

4.2.9 Forward Stepwise Regression

Forward stepwise regression was performed in order to determine which variables in combination contributed most significantly to TTO success. The optimal model (p=.004) found business experience and state funding to be positively correlated with TTO success, although the relationships were marginally significant (p=.07 and p=.08 respectively). Surprisingly, TTO success was negatively associated with marketing emphasis, and the correlation was highly significant (p=.001). No other factors were statistically significant in the model.

Overall, the model explained 33.6 percent of the variation in TTO composite score (r-square=.336). The negative correlation to marketing emphasis was responsible for approximately 20 percent of the variation, followed by state funding at 6.8 percent, and then business expertise at 6.6 percent. The summary statistics can be found in Appendix 8.10.

5 Suggestions for TTO Success

Our most important finding was that business expertise was statistically significant as a lone factor and in a multiple factor model, and was the only factor found to be positively correlated to TTO success in both analyses. We can confidently conclude that the presence of an MBA or business professional is a factor correlated to TTO success.

While royalty incentives and marketing emphasis were found to be negatively correlated to TTO success, we do not suggest that TTOs should downgrade their websites or that universities should begin reducing royalty plans. We merely conclude that these factors are negatively correlated with TTO success, and the most successful TTOs had lower than average website ratings and royalty incentives.

A marginally significant positive correlation was found between state funding and TTO success. This suggests that state funding of technology commercialization is associated with TTO success, as one might expect.

Although these results are open to modification based on different factors, based on our research, the presence of business expertise and state funding and support are correlated with successful TTOs. Therefore, offices making efforts toward incorporating these factors may experience greater success in commercializing their available technologies.

6 Suggestions for Further Research

Based on the research we conducted, we believe there are several areas where future research would yield interesting results and further our understanding of TTO success.

First, as part of our ranking criteria, we eliminated all schools sharing a TTO office between the university and its affiliated medical school. Potentially, applying the same analysis as used in this report, it may be possible to see which factors are alone significant, and which multivariate model is the best predictor of TTO success when the medical school is included.

Second, one could make modifications to the actual rubrics and ranking criteria we used in this report. More specifically, the "active technology" factor may yield different results because it did not effectively partition the variation in this factor. Therefore, if this factor is modified our findings might also be influenced.

Third, the data used to calculate state funding was a summation of three categories of funding: (1) state research investments, (2) technology maturation seed funding and (3) VC investments. If these categories are treated separately, it may be possible to determine which, if any, lead to greater TTO success than the others.

Finally, when considering a TTO's marketing strategy, which was a basic website rating in our analysis, the rating might yield more helpful data if specific features of a TTO's website are considered. When this factor was considered in our report, it was prefaced by disclaiming its highly subjective nature. More specifically, since different observers might find features more useful than others, in the future, it might be helpful to isolate those features and test how they enhance a TTO's success. We expected a positive correlation; however, there was a negative correlation with marketing emphasis, which is even further reassurance that specificity might assist in isolating effective strategies.

Overall, many modifications and variations can be used in future research in the area of TTO success. However, based on our actual findings, the above suggestions are most closely related to the research contained within this analysis.

7 Conclusion

Our research models returned results that agree with prior research with respect to business expertise and state funding, two factors we expected to be associated with successful TTOs. We therefore conclude that our composite efficiency score is a useful measure for overall TTO success, and successfully accounts for a TTO's ability to generate licensing revenue, negotiate licenses and options, and launch startup businesses. Also, higher levels of business experience and state funding for technology commercialization are correlated with TTO success.

Future research analyzing TTO success may also include using other "non-traditional" measures of university success beyond licensing revenue, number of licenses, and number of start-ups to develop composite efficiency scores.[20] "Non-traditional" factors used to develop composite scores to rank TTOs, such as university contribution to economic development may provide different results than found in this report.

In the future, further research that incorporates medical schools, varies the factors used in our scoring rubrics by pin pointing more specific categories for scoring, e.g., expanding the number of active technologies or looking at specific marketing strategies, might yield interesting, succinct and positively correlated success factors.

[20] *Moving Beyond the Transactional Metric: A National Workshop to Identify Additional Measures of University Contributions to Regional Economic Growth and Innovation*, National Association of State Universities and Land Grant Colleges, (2009). Proposal to the National Science Foundation.

Finally, since our research tests and affirms prior findings of TTO success factors, incorporating these strategies may prove useful to TTOs that do not currently employ such tactics.

8 Appendices

8.1 Phan & Siegel Summary

Summary of Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* (2006)

Phillip H. Phan is Vice Dean for Faculty & Research and Professor of Entrepreneurship at The Johns Hopkins Carey Business School, and earned his PhD in 1992 from the University of Washington.

Donald S. Siegel is Dean of the School of Business and Professor of Management at the University at Albany, SUNY, and in 1988 earned his PhD in economics from Columbia University.

Phan & Siegel (2006) constitutes the foundation of our report.[21] In that study, researchers summarized the findings of a broad array of reports on technology transfer efficiency and effectiveness. The purpose of Phan & Siegel's study was to advance existing knowledge of technology commercialization and identify those factors most influential to the success of technology transfer offices (TTOs). TTOs often represent a substantial source of research benefits, revenue, and job creation thus demanding the attention of universities, policymakers, and the private sector.

This summary discusses the following issues identified in Phan & Siegel's report: the importance of university policies and culture in determining TTO success, the significance and effect of royalty distributions to faculty-inventors, factors determining the success of start-up companies pursued by a TTO, and certain factors surprisingly not associated with TTO success.

I. Importance of University Policies and Cultural Factors in Determining TTO Success

As noted in Phan & Siegel (2006), a variety of university policies, both intangible cultural factors and official rules, significantly influence TTO effectiveness. Specifically, university TTOs achieve the greatest success when universities commit to developing an

[21] Phillip H. Phan & Donald S. Siegel, *The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the U.S. and the U.K.* (April 2006) *available at* http://www.economics.rpi.edu/workingpapers/rpi0609.pdf (last visited Mar. 31, 2009).

entrepreneurial culture with strong ties to industry. As part of this commitment, universities must put more resources into TTOs, which often includes hiring TTO personnel with business, marketing, and entrepreneurial experience.[22]

In Siegel, Waldman, and Link (2003) researchers found that a University's policies relating to organizational culture and intellectual property can affect TTO effectiveness. By surveying one hundred stakeholders in TTOs at five universities, the researchers concluded that significant barriers, both cultural and informational, existed between universities and firms, and that these barriers must be considered in the commercialization process. The researchers found these barriers most pronounced between universities and small firms as compared to large firms. Additionally, the researchers determined that factors detrimental to TTO success include high turnover among TTO employees, inadequate marketing and business development skills, and non-incentive-based compensation.[23]

Franklin, Wright, and Lockett (2001) also found that cultural and informational barriers prevented TTOs in the U.K. from adopting entrepreneurial-friendly policies. In this study, researchers compared the rate of start-up formation between old, well-established U.K. universities and newer U.K. universities. The researchers found that the established universities were significantly more receptive to entrepreneurial start-ups because these universities had the most favorable policies regarding entrepreneurs who were not otherwise connected to the university.[24]

Clark (1998) conducted a similar analysis using five European universities that excelled at technology transfer. In this study, Clark found that the ability of these

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[22] *See* Gideon Markman, Peter Gianiodis, Phillip Phan, & David Balkin, *Entrepreneurship From the Ivory Tower: Do Incentive Systems Matter*, 29 J. Tech. Transfer 353-64 (2004) *noted in* Phan & Siegel at 15 (finding higher compensation for TTOs employees is associated with more equity licensing and start-up formation at the TTO).

[23] Donald Siegel, David Waldman, & Albert Link, *Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study*, 32 RES. POL'Y 27-48 (2003) *noted in* Phan & Siegel at 8.

[24] Stephen Franklin, Mike Wright, & Andy Lockett, *Academic and Surrogate Entrepreneurs in University Spin-Out Companies*, 26 J. TECH. TRANSFER 127-41 (2001) *noted in* Phan & Siegel at 9-10. *See also* EDWARD ROBERTS, ENTREPRENEURS IN HIGH TECHNOLOGY, LESSONS FROM MIT AND BEYOND (Oxford University Press, 1991) (finding social norm of accepting entrepreneurs as part of culture at MIT was a critical factor determining success of entrepreneurial policies) *noted in* Phan & Siegel at 8.

institutions to instill an entrepreneurial culture in their TTOs was critical to these institutions' success. Thus, this study also supports the importance of culture and norms in determining TTO success.[25]

In general, group norms seem to be most effective in stimulating commercialization activity when they come from individual departments rather than being imposed from the highest levels of a university. For example, Louis, Blumenthal, Gluck, and Soto (1989) considered this issue by sampling faculty in the life-sciences departments of the fifty research universities in the U.S. that received the most funding from the National Institutes of Health. The researchers found that local group norms within individual departments, and not university policies or organizational structures, were the most significant factor determining faculty involvement in technology commercialization.[26]

Analyzing a subdivision even further below the department level of a university, Bercovitz & Feldman (2004) studied the likelihood of individual medical school researchers to disclose inventions to their TTOs at Duke University and Johns Hopkins University. Bercovitz & Feldman found that the medical researchers' decision to disclose was strongly influenced by three factors: the norms to which the researchers were exposed at the university where they were trained, the disclosure-related norms at the researchers' current institution as observed from the actions of peers, and the disclosure-related norms of department chairs at a researchers' current institution.[27]

II. The Significance of Royalty Distribution Formulas and Incentive-based Compensation

A university's compensation system is significant in determining TTO success. Perhaps not surprisingly, a fair conclusion from the studies presented in Phan & Siegel's

[25] Burton Clark, *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*, 38 HIGHER EDUC. 373-74 (1998) *noted in* Phan & Siegel at 8.

[26] Karen Louis, David Blumenthal, Michael Gluck, & Michael Soto, *Entrepreneurs in Academe: An Exploration of Behaviors Among Life Scientists*, 34 ADMIN. SCI. Q. 110-31 (1989) *noted in* Phan & Siegel at 26-27.

[27] Janet Bercovitz & Maryann Feldman, *Academic Entrepreneurs: Social Learning and Participation in University Technology Transfer*, PROCEEDINGS (2006) *available at* http://www.hhh.umn.edu/img/assets/11469/bercovitz_academic_entrepreneurs.pdf (last visited Mar. 31, 2009) *noted in* Phan & Siegel at 26.

report is that TTOs become more successful the more inventors can personally profit from their inventions through the TTO. But, there is also a noticeable tradeoff between licenses and spin-off companies as higher royalty rates from licensing decrease the incentive for faculty to pursue a startup.[28] Universities tend to prefer licenses because royalties are a stable, consistent and often significant revenue streams even though riskier startups could provide substantially higher returns in the long-run.

Phan & Siegel also highlight a dilemma faced by most universities regarding compensation. On the one hand, universities are institutions of higher learning dedicated to educating students and increasing the global knowledge pool through experimental research that private industry may consider too preliminary and risky. But, universities have also recently seen dramatic declines in endowments and donations, which threaten the stability of these institutions as a whole. While universities should not be run with a primary focus on the bottom line, more advantageous incentive compensation for faculty and TTO personnel offers a potential solution to this problem.

As Phan & Siegel recognized, the advantages of incentive-based compensation in the form of royalty payments to faculty members for their inventions have been documented in a number of studies. For example, in a follow-up report to their comprehensive 2003 study, Link & Siegel (2005) found that universities allocating a higher percentage of royalty payments to faculty members tend to be more efficient in licensing faculty technologies.[29] Similarly, Debackere & Veugelers (2005) found that TTOs were more effective in commercializing faculty inventions when universities allocated a higher percentage of royalty payments to the inventors. In this study, the researchers compared the TTO of K. U. Leuven, a Belgian university, with eleven other research universities in Europe.[30]

[28] *See* Dante DiGregorio & Scott Shane, *Why Do Some Universities Generate More Start-ups than Others?*, 32 RES. POL'Y 209-27 (2003) *noted in* Phan & Siegel at 15 (finding a negative correlation between more favorable royalty distribution formulas and start-up formation because more royalties raises the opportunity cost of pursuing start-ups as compared to licensing).

[29] Albert Link & Donald Siegel, *Generating Science-Based Growth: An Econometric Analysis of the Impact of Organizational Incentives on University-Industry Technology Transfer,* 11 EUR. J. FIN. 169-81 (2005) *noted in* Phan & Siegel at 13.

[30] Koenraad Debackere & Reinhilde Veugelers, *The Role of Academic Technology Transfer Organizations in Improving Industry Science Links*, 34 RES. POL'Y 321-42 (2005) *noted in* Phan & Siegel at 37.

III. Factors Determining a University's Rate of Start-up Formation

Another set of studies from Phan & Siegel discuss the factors influencing a university's rate of startup formation. Since forming a successful new venture requires significant time, resources, and specialized skills, TTOs are most successful in spinning off new ventures based on faculty inventions when the parent university is committed to supporting these startups.

According to Lockett & Wright (2005), university support in the form of hiring TTO personnel with entrepreneurial experience as opposed to patent experience, increasing expenditures on intellectual property, and establishing more favorable royalty distribution formulas for faculty is positively correlated with start-up formation. Lockett & Wright applied the resource-based view of a TTO to find that a TTO's competitive advantage is found in its internal resources and capabilities, which is determined by the extent of a university's commitment to the TTO and commercialization activities.[31]

University support, however, is a necessary but insufficient condition for TTO success. For example, applying a sophisticated econometric technique used in earlier studies, O'Shea, Allen, & Chevalier (2005) found that higher rates of startup formation were significantly determined by a TTO's past success in technology transfer, the quality of the institution's faculty, the commercial capabilities of the TTO, and extent of federal science and engineering funding the university receives.[32] Thus, while universities can provide the necessary financial resources and faculty, a TTO must establish the necessary internal capabilities and experience over time to become successful.

[31] Andy Lockett & Mike Wright, *Resources, capabilities, risk capital and the creation of university spin-out companies*, 34 RES. POL'Y 1043-57 (2005) *noted in* Phan & Siegel at 11-12.

[32] Rory O'Shea, Thomas Allen & Arnaud Chevalier, *Entrepreneurial Orientation, Technology Transfer, and Spin-off Performance of U.S. Universities*, 34 RES. POL'Y 994-1009 (2005) *noted in* Phan & Siegel at 15-16. *See also* Dante DiGregorio & Scott Shane, *Why Do Some Universities Generate More Start-ups than Others?*, 32 RES. POL'Y 209-27 (2003) *noted in* Phan & Siegel at 15 (applying a regression analysis to AUTM data from one hundred universities and over five hundred related start-ups finding faculty quality and the ability of inventors to receive equity in start-ups instead of licensing royalties were two key determinants of TTO start-up formation); Lynne Zucker, Michael Darby & Jeff Armstrong, *University Science, Venture Capital, and the Performance of U.S. Biotechnology Firms*, UCLA (2000) *noted in* Phan & Siegel at 25 (finding ties between university "star scientists" and firm scientists has a positive effect on number of patents granted, number of products in development, and number of products on the market).

Recognizing the importance of a TTO's internal capabilities, Markman, Phan, Balkin & Giannodis (2005) found that the faster a TTO can commercialize and patent a new technology, the higher the university's overall returns and rate of start-up formation. Thus, TTO speed and efficiency are significant predictors of start-up formation. These researchers identified three factors they believe determine a TTO's speed: participation of the inventor in the commercialization process, a TTO's competency in identifying licensees, and the extent of the TTO's resources. This study also found that in early stages of commercialization the faculty-inventor's involvement hindered a TTO's commercialization speed more than a lack of resources, while in later stages the inventor's played a more positive role. [33]

TTOs can improve their speed and efficiency, and thus earn higher returns for universities, if the TTOs have the necessary resources and support.[34] A major part of these resources is human capital. Thus, Markman, Gianiodis & Phan (2006) found that faculty-inventors are more likely to disclose inventions to TTOs that have "professionalized" their staff. The researchers analyzed a statistically random sample of nearly 24,000 faculty-inventors at over fifty U.S. universities and found that professionalized staff can better monitor activity in individual departments to encourage more disclosures. The researchers also found that the more faculty-inventors bypassed the TTO with new inventions, the more entrepreneurial activity was stimulated and more valuable discoveries produced, thus highlighting the need for universities to loosen restrictions on such discoveries.[35]

According to Franklin, Wright & Lockett (2001), universities can increase their chances of forming successful start-ups by combining "academic and surrogate

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[33] Gideon Markman, Peter Gianiodis, Phillip Phan & David Balkin, *Innovation Speed: Transferring University Technology to Market*, 34 RES. POL'Y 1058-75 (2005) *noted in* Phan & Siegel at 11.

[34] Resources in the form of legal expenses also have an impact. One study concluded that spending more on lawyers reduces the number of licensing agreements but increases licensing revenue overall. *See* Donald Siegel, David Waldman & Albert Link, *Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study*, 32 RES. POL'Y 27-48 (2003) *noted in* Phan & Siegel at 34.

[35] Gideon Markman, Peter Gianiodis & Phillip Phan, *An Agency Theoretic Study of the Relationship Between Knowledge Agents and University Technology Transfer Offices* (Rensselaer Polytechnic Institute, Working Paper, 2006).

entrepreneurship". Academic entrepreneurship refers to the extent to which a university employs entrepreneurial faculty at the TTO and individual departments, while surrogate entrepreneurship refers to a university's ability to bring in entrepreneurs from outside the university. The combination of these elements, according to the researchers, enables universities to apply the industry knowledge of surrogate entrepreneurs with higher rates of inventor involvement at TTOs.[36]

In a follow-up report, these same researchers also found that the universities of successful TTOs were able to exploit larger social networks and greater expertise in forming start-ups often leading to more widely dispersed equity ownership in start-ups than at less successful universities. Furthermore, the researchers found these successful universities had clear, well-defined strategies regarding start-up formation and ownership than less successful universities. Lastly, these researchers also found that the role of faculty-inventors was largely the same at highly successful and less successful universities in the start-up formation process.[37]

A final issue Phan & Siegel address in their report is a university's selectivity in start-up formation. Universities, like all commercial entities, are often presented with more options than they can feasibly pursue. Powers & McDougall (2005) considered a university's tradeoff between selectivity in choosing technologies to spinoff into a new venture and the level of support the university provides for the TTOs. Powers & McDougall found that highly selective universities that provided a high degree of TTO support earned lower returns than less selective universities with strong TTO support. The researchers also found that universities providing a moderate level of TTO support would see lower returns from increasing selectivity, but only up to a point. Thus, it seems the ideal policy for a university to adopt to maximize returns is low selectivity in forming start-ups and strong TTO support.[38] Phrased differently, universities are most successful when they hedge their bets, providing strong support for a wide swath of start-ups based on faculty inventions, much like a venture capital firm.

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[36] Stephen Franklin, Mike Wright & Andy Lockett, *Academic and Surrogate Entrepreneurs in University Spin-out Companies*, 26 J. TECH. TRANSFER 127-41 (2001) *noted in* Phan & Siegel at 34.
[37] Andy Lockett, Mike Wright & Stephen Franklin, *Technology Transfer and Universities' Spin-out Strategies*, 20 Small Bus. Econ. 185-200 (2003) *noted in* Phan & Siegel at 34-35.

[38] Joshua Powers & Patricia McDougall, *Policy Orientation Effects on Performance with Licensing to Start-Ups and Small Companies*, 34 RES. POL'Y 1028-42 (2005) *noted in* Phan & Siegel at 18-19.

Degroof & Roberts (2004) also consider the tradeoff between selectivity and support. The researchers analyzed four types of start-up policies ranging from minimal selectivity and support to comprehensive selectivity and support finding the latter is optimal for a university to produce start-ups with high growth potential. But, the researchers also find this policy is simply not feasible as all universities possess only a limited amount of resources. Thus, this study emphasizes the need for a strong commitment from the universities in addition to the internal capabilities of a TTO to maximize returns.[39]

IV. Factors Not Associated With TTO Success

Some of the studies discussed in Phan & Siegel's report also indicated factors not significant in determining TTO success. First, DiGregorio & Shane (2003) found that the availability of venture capital funding in university's region and the percentage of a university's research budget derived from industry are insignificant factors in determining the rate of start-up formation. The researchers used the percentage of the university's research budget derived from industry as a proxy for the university's commercial orientation perhaps indicating that regardless of a university's location or connections to industry, a strong invention is likely to be commercialized regardless of the source or location of the inventor.[40]

Additionally, Lockett & Wright (2005) found that the number of startups formed by universities was not significantly associated with number of TTO staff or years a TTO has been in existence. This study analyzed survey data from all research universities in the U.K. and controlled for regional differences in research expenditures and the presence of medical schools.

V. Conclusion

Considering the many studies discussed in Phan & Siegel's report, it seems clear that TTOs success requires a high level of commitment from universities. This

[39] Jean-Jacques Degroof & Edward Roberts, *Overcoming Weak Entrepreneurial Infrastructure for Academic Spin-off Ventures*, 29 J. TECH. TRANSFER 327-57 (2004) *noted in* Phan & Siegel at 9.

[40] Dante DiGregorio & Scott Shane, *Why Do Some Universities Generate More Start-ups than Others?*, 32 RES. POL'Y 209-27 (2003) *noted in* Phan & Siegel at 15.

commitment should be in the form of proper policies regarding royalty distributions to inventors, incentive-based compensation for TTO personnel, and clear guidelines on start-ups. Additionally, universities can support commercialization activities by supplying the necessary human capital such as entrepreneurial faculty, TTO employees with business development or marketing experience, and wide social networks of alumni and external entrepreneurs. But the onus for higher returns does not rest solely on the universities as TTOs must develop their internal capabilities as well in order to become more efficient in the commercialization process.

8.2 Full Time Employees Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.318(a)	.101	.087	38.38450

a Predictors: (Constant), FTER

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10311.451	1	10311.451	6.999	.010(a)
	Residual	91348.908	62	1473.369		
	Total	101660.359	63			

a Predictors: (Constant), FTER
b Dependent Variable: composite

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	122.548	10.852		11.292	.000
	FTER	-18.943	7.161	-.318	-2.645	.010

a Dependent Variable: composite

8.3 Incubator Support Results

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4016.913	1	4016.913	2.627	.110(a)
	Residual	91760.055	60	1529.334		
	Total	95776.968	61			

a Predictors: (Constant), incubator
b Dependent Variable: composite

8.4 Royalty Incentive Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.415(a)	.172	.157	37.52170

a Predictors: (Constant), royalties

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	35.627	17.952		1.985	.052
	royalties	16.636	4.916	.415	3.384	.001

a Dependent Variable: composite

8.5 Industry Experience Results

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	68.267	1	68.267	.042	.838(a)
	Residual	64844.305	40	1621.108		
	Total	64912.571	41			

a Predictors: (Constant), Indexp
b Dependent Variable: composite

8.6 Marketing Emphasis Results

ANOVA(b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.770	1	1.770	.001	.974(a)
	Residual	101658.589	62	1639.655		
	Total	101660.359	63			

a Predictors: (Constant), marketing
b Dependent Variable: composite

8.7 State Funding Results

ANOVA(b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2341.897	1	2341.897	1.462	.231(a)
	Residual	99318.462	62	1601.911		
	Total	101660.359	63			

a Predictors: (Constant), StateF
b Dependent Variable: composite

8.8 Business Experience Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.380(a)	.145	.128	39.58035

a Predictors: (Constant), BIZ

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13257.502	1	13257.502	8.463	.005(a)
	Residual	78330.190	50	1566.604		
	Total	91587.692	51			

a Predictors: (Constant), BIZ
b Dependent Variable: composite

Coefficients(a)

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

		B	Std. Error	Beta	B	Std. Error
1	(Constant)	133.825	14.407		9.289	.000
	BIZ	-11.132	3.827	-.380	-2.909	.005

a Dependent Variable: composite

8.9 *Active Technologies Results*

ANOVA(b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	26.794	1	26.794	.017	.898(a)
	Residual	90743.430	56	1620.418		
	Total	90770.224	57			

a Predictors: (Constant), Atech
b. Dependent Variable: composite

8.10 *Forward Stepwise Regression Results*

Descriptive Statistics

	Mean	Std. Deviation	N
composite	84.4722	41.27987	36
Royalties	3.4722	.99960	36
BIZ	3.6944	1.23796	36
FTER	1.5000	.81064	36
Incubator	3.2500	1.36015	36
StateF	2.0556	1.28607	36
Indexp	4.1944	.98036	36
Atech	4.5278	1.15847	36
Marketing	3.9722	.97060	36

Correlations

		Comp.	Roy.	BIZ	FTE	Incub.	StateF	Indexp	Atech	mktg
Pearson Correlation	composite	1.000	.323	-.167	-.206	-.001	-.196	.097	.171	.450
	royalties	.323	1.000	.051	-.088	-.152	.046	.283	-.271	.249
	BIZ	-.167	.051	1.000	.327	.064	.011	.686	.056	.183
	FTER	-.206	-.088	.327	1.000	-.117	.027	.306	.015	.054
	incubator	-.001	-.152	.064	-.117	1.000	.057	.027	-.122	.157
	StateF	-.196	.046	.011	.027	.057	1.000	.127	-.231	.139

	Indexp	.097	.283	.686	.306	.027	.127	1.000	.133	.366
	Atech	.171	-.271	.056	.015	-.122	-.231	.133	1.000	.293
	marketing	.450	.249	.183	.054	.157	.139	.366	.293	1.000
Sig. (1-tailed)	composite	.	.027	.166	.114	.497	.126	.286	.159	.003
	royalties	.027	.	.385	.305	.188	.396	.047	.055	.071
	BIZ	.166	.385	.	.026	.356	.475	.000	.373	.143
	FTER	.114	.305	.026	.	.249	.437	.035	.465	.376
	incubator	.497	.188	.356	.249	.	.370	.438	.239	.180
	StateF	.126	.396	.475	.437	.370	.	.230	.087	.210
	Indexp	.286	.047	.000	.035	.438	.230	.	.219	.014
	Atech	.159	.055	.373	.465	.239	.087	.219	.	.041
	marketing	.003	.071	.143	.376	.180	.210	.014	.041	.
N	composite	36	36	36	36	36	36	36	36	36
	royalties	36	36	36	36	36	36	36	36	36
	BIZ	36	36	36	36	36	36	36	36	36
	FTER	36	36	36	36	36	36	36	36	36
	incubator	36	36	36	36	36	36	36	36	36
	StateF	36	36	36	36	36	36	36	36	36
	Indexp	36	36	36	36	36	36	36	36	36
	Atech	36	36	36	36	36	36	36	36	36
	marketing	36	36	36	36	36	36	36	36	36

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	marketing	.	Forward (Criterion: Probability-of-F-to-enter <= .100)
2	StateF	.	Forward (Criterion: Probability-of-F-to-enter <= .100)

3	BIZ	.	Forward (Criterion: Probability-of-F-to-enter <= .100)

a Dependent Variable: composite

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.450(a)	.202	.179	37.41088
2	.520(b)	.270	.226	36.32013
3	.580(c)	.336	.274	35.17607

a Predictors: (Constant), marketing
b Predictors: (Constant), marketing, StateF
c Predictors: (Constant), marketing, StateF, BIZ

ANOVA(d)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12055.457	1	12055.457	8.614	.006(a)
	Residual	47585.515	34	1399.574		
	Total	59640.972	35			
2	Regression	16108.971	2	8054.485	6.106	.006(b)
	Residual	43532.001	33	1319.152		
	Total	59640.972	35			
3	Regression	20045.576	3	6681.859	5.400	.004(c)
	Residual	39595.396	32	1237.356		
	Total	59640.972	35			

a Predictors: (Constant), marketing
b Predictors: (Constant), marketing, StateF
c Predictors: (Constant), marketing, StateF, BIZ
d Dependent Variable: composite

Coefficients(a)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta	B	Std. Error
1	(Constant)	8.518	26.620		.320	.751
	marketing	19.121	6.515	.450	2.935	.006
2	(Constant)	19.722	26.623		.741	.464
	marketing	20.673	6.387	.486	3.237	.003
	StateF	-8.449	4.820	-.263	-1.753	.089
3	(Constant)	44.004	29.157		1.509	.141
	marketing	22.729	6.292	.534	3.612	.001
	StateF	-8.573	4.669	-.267	-1.836	.076
	BIZ	-8.715	4.886	-.261	-1.784	.084

a Dependent Variable: composite

Excluded Variables(d)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
		Tolerance	Tolerance	Tolerance	Tolerance	Tolerance
1	royalties	.224(a)	1.441	.159	.243	.938
	BIZ	-.257(a)	-1.697	.099	-.283	.967
	FTER	-.231(a)	-1.538	.134	-.259	.997
	incubator	-.073(a)	-.468	.643	-.081	.975
	StateF	-.263(a)	-1.753	.089	-.292	.981
	Indexp	-.078(a)	-.467	.643	-.081	.866
	Atech	.044(a)	.268	.790	.047	.914
2	royalties	.228(b)	1.510	.141	.258	.938
	BIZ	-.261(b)	-1.784	.084	-.301	.966
	FTER	-.226(b)	-1.551	.131	-.264	.997
	incubator	-.064(b)	-.420	.678	-.074	.974
	Indexp	-.055(b)	-.338	.737	-.060	.860
	Atech	-.038(b)	-.230	.820	-.041	.839
3	royalties	.229(c)	1.575	.125	.272	.938
	FTER	-.160(c)	-1.048	.303	-.185	.892
	incubator	-.055(c)	-.369	.715	-.066	.973
	Indexp	.248(c)	1.179	.247	.207	.462
	Atech	-.038(c)	-.240	.812	-.043	.839

a Predictors in the Model: (Constant), marketing
b Predictors in the Model: (Constant), marketing, StateF
c Predictors in the Model: (Constant), marketing, StateF, BIZ
d Dependent Variable: composite

