

## Gender Analysis Of Invention Disclosures And Companies Founded By Stanford University Faculty From 2000-2014

By Serena Hanes, Katharine Ku, Lisa Primiano, and Ann M. Arvin

### Abstract

This study examined gender differences in entrepreneurship by faculty at a major U.S. research university using data from the Stanford Office of Technology Licensing from 2000-2014 and relevant public data. Differences in participation by men and women faculty in reporting inventions were observed based on the total number of invention disclosures and the number of faculty who disclosed during the study period. As demonstrated through invention disclosures, women faculty increasingly engaged in offering their discoveries for possible commercial development to benefit the public. However, they remain much less likely than their men counterparts to be involved with start-up companies and in leadership roles among companies licensing university-generated intellectual property. Universities can track these activities through their licensing offices to devise strategies that encourage and facilitate the engagement of women faculty with technology transfer and formation of new companies.

### Introduction

Invention disclosures and licensing activities represent one important way in which discoveries made at research universities can be transferred for the benefit of society because these steps trigger the process of developing useful applications of the invention and their commercialization. As a consequence of the Bayh-Dole Act of 1980, universities in the United States are given the authority to seek disclosures of intellectual property (IP) and to file patents and undertake licensing of IP created by faculty in the course of their federally funded research. At most universities, this practice is applied to IP generated in the course of the faculty member university responsibilities and using university resources, regardless of the source of research funding. While most licenses are taken by established companies, many university inventions are at an early stage of development, lacking sufficient proof of concept data to be of immediate commercial interest. In these circumstances, the university may enter into a licensing agreement with a start-up company formed to move the technology forward. In some cases, the faculty inventors are involved as founders of the start-up company.

Although this approach to university technology transfer has been in place for decades, information

about engagement of women faculty in these activities is limited. An overall gender gap in STEM innovation has been documented by the National Science Foundation (2013) and Nager (2016) found that women represented only 12 percent of U.S. innovators (defined as the people behind meaningful and marketable innovations). A study of biosciences patents also showed a gender gap even though more women have received Ph.D. degrees in these disciplines since 1995 (Jensen 2011). Stanford University offers a unique population and sample set to examine questions about participation of women faculty in technology transfer because of the diverse faculty with strengths in both life sciences and engineering. One major role of the Stanford Office of Technology Licensing (OTL) is to transfer university technologies for public use and benefit by managing Stanford IP, including IP generated by faculty in the course of their university responsibilities. Stanford OTL has gained extensive experience having reviewed over 10,000 disclosures (~500/year) in the last 45 years. OTL has granted approximately 10 percent of its licenses to start-up companies as a result of the robust entrepreneurial ecosystem at Stanford.

Our aim for this study was to review participation by women along the continuum

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of commercialization from initially disclosing intellectual property, to forming companies, to participating on company boards, to serving on the company leadership team. We focused on disclosure trends from 2000-2014 and gender differences in company formation. For active start-ups, we gathered data to analyze the downstream influence of the gender of faculty founders on whether they participated in the boards of the start-up company and the gender composition of the company board and leadership.

We conclude that substantial progress has been made in the participation of women faculty in technology transfer, as shown by higher rates of women faculty disclosing inventions related to their university research. However, women faculty at Stanford are substantially less likely than men faculty to engage in creating start-up companies and men occupy most leadership positions of faculty-founded companies that have active licenses for patents based on university research.

## Materials and Methods

OTL receives all invention disclosures and executes all licenses for University-owned technologies and maintains the information in its proprietary database. We focused on the years 2000-2014 in order to capture more recent trends in the engagement of women faculty in these activities. Faculty and start-up companies were not contacted to provide any information. All data was retrieved between March 1, and April 30, 2015.

Faculty, Inventors and Disclosure Events. The Office of the Vice Provost for Faculty Affairs at Stanford provided data for total numbers of faculty by gender during each year of the study period. The data included university-tenure line (UTL), non-tenure research line (NTL) and medical center line (MCL) faculty, who are eligible to serve as principal investigators on extramurally funded research grants. Since there are very few research line faculty, these were grouped with the tenure line faculty.

We retrieved the number, gender, and school designations for faculty inventors from the OTL database based on invention disclosures submitted between 2000 and 2014. Some faculty inventors disclosed more than one invention during the time period and in these cases, they were counted only once per year of the disclosure event. We obtained the number of disclosure events from the invention disclosures in the OTL database for the years 2000 to 2014. Each instance of a faculty inventor listed on an invention disclosure was counted as a disclosure event. Therefore, if an invention disclosure listed two faculty inventors it was counted as two disclosure events. When faculty members disclosed multiple times per year, each disclosure was counted as a separate disclosure event.

Faculty Start-ups. A start-up company was defined as a

company founded by one or more Stanford faculty members based on IP owned by Stanford. Student start-ups were not included. We retrieved start-up and founder information from the OTL database for all start-ups that executed licenses between 2000 and 2014.

The faculty-founded start-ups were categorized by gender of the faculty founders: All Male—only male faculty founders; Any Female—at least one female founder. We divided the faculty-founded start-ups into four groups based on the status of the company and their license during the study period: Active—company exists and continues to license the Stanford technology; Acquired—start-up acquired by another entity; Defunct—company no longer exists; Former—company still exists but no longer licenses the Stanford technology.

Start-up Boards and Leadership. We analyzed the gender distribution of the chief executive officers (CEO) and board members of active faculty-founded start-up companies using internal and external sources. First we ascertained any information available in OTLs database regarding the gender of the scientific advisory board (SAB) and board of director (BOD) members and the CEO for each company. If the board membership and CEO information related to the start-up companies was not available in the OTL database, we searched for public data available on company websites. If the information could not be obtained from the company website, we searched Bloomberg, Crunchbase, PrivCo, and LinkedIn. We assumed that the CEO participated on the BOD and therefore included CEOs in the overall count of BOD members.

## Results

Gender of Faculty and Inventors. Stanford had an average of 1802 faculty in the UTL, NTL and MCL each year from 2000-2014. On average, 213 (12 percent) of these faculty members per year were inventors, including an average of 181 men and 32 women per year (Table 1A).

When we analyzed the number of faculty who were inventors, we found that 860 faculty members submitted invention disclosures to OTL from 2000-2014, including 709 men and 151 women. Each time a faculty member was listed on a separate invention disclosure, it was considered a disclosure event. There were 6005 faculty disclosure events between 2000-2014, 5157 by male inventors and 848 by female inventors (Table 1B).

When we considered these three metrics—numbers of faculty, inventors and disclosure events—for the entire 15 year period, we calculated that 25 percent of faculty members were women, but only 15 percent of faculty inventors were women and 14 percent of disclosure events were from women. A higher percentage of male faculty (13 percent) than female faculty (seven percent) were inventors and those male inven-

# Gender Analysis Of Invention Disclosures

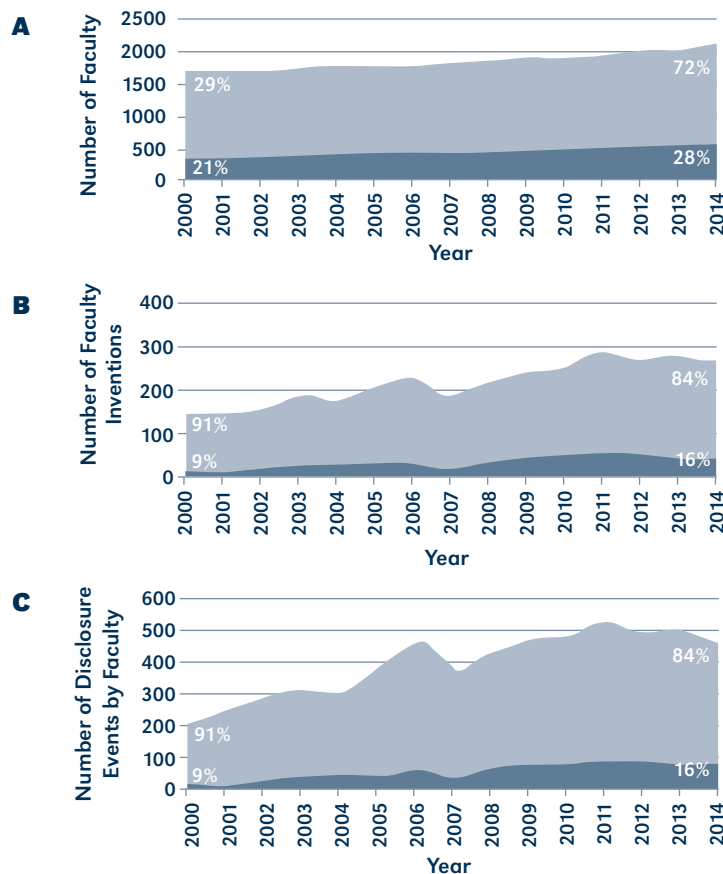
**Table 1. Faculty And Invention Disclosures By Gender 2000-2014.**

Gender of faculty	Average # of Faculty	Average # of Faculty Inventors	% of Faculty who Disclosed		
			Average	Median	Range
Male	1356 (75%)	181 (85%)	7.27	3	1-112
Female	446 (25%)	32 (15%)	5.62	2	1-64
<b>Total</b>	<b>1802</b>	<b>213</b>			

Gender of faculty	# of Faculty Inventors	# of Faculty Disclosure Events	# of Disclosure Events per Faculty Inventor		
			Average	Median	Range
Male	709 (82%)	5157 (86%)	7.27	3	1-112
Female	151 (18%)	848 (14%)	5.62	2	1-64
<b>Total</b>	<b>860</b>	<b>6005</b>			

**Figure 1. Annual Comparison Of Faculty, Faculty Inventors, And Faculty Disclosure Events By Gender**



**A.** The total number of male (blue) and female (red) faculty each year from 2000-2014. **B.** The number of male (blue) and female (red) faculty inventors (n=860) each year from 2000-2014. **C.** The number of disclosure events (n=6005) by male (blue) and female (red) faculty inventors each year from 2000-2014. Some faculty disclosed multiple inventions and some disclosures had more than one faculty inventor.

tors were more prolific than female inventors, averaging 30 percent more invention disclosures per person than female inventors (Tables 1A, 1B).

The gender distribution of Stanford faculty has changed over the 15 years of this study. Women comprised 21 percent of faculty members (338 of 1625 total faculty) in 2000 and 28 percent (569 of 2062 total faculty) in 2014 (Figure 1A). The increase in female faculty was associated with an increasing percentage of female faculty inventors and female faculty disclosure events. In 2000, nine percent of faculty inventors were women (13 of 143 total faculty inventors), rising to 16 percent of faculty (41 of 263 total faculty inventors) in 2014 (Figure 1B). In 2000, nine percent of faculty disclosure events were from women (19 of 220 total disclosure events), rising to 16 percent (74 of 466 total disclosure events) (Figure 1C). Thus, while the overall numbers of women have increased across all three metrics over time, there appears to be a persistent discrepancy between the proportion of women in the faculty compared to the proportion of women inventors or disclosure events by women compared to men.

Inventors and Disclosure Events by School. The data presented in Table 1 and Figure 1 includes the total faculty from all of the schools across the university. However, the schools varied in the gender distribution of their faculty (Table 2A), the proportion of faculty who were inventors (Table 2B), and the disclosure events by faculty (Table 2C) over the study period. For example, the School of Engineering had the lowest percentage of women on faculty (12 percent on average per year) and its faculty were the most likely to be inventors (26 percent on average per year) while the School of Education had the highest percentage of women on faculty (42 percent on average per year) but a very low percentage of faculty who were inventors (four percent on average per year).

Of the 860 inventors from 2000-2014, 323 (38 percent) were ten-

**Table 2. Faculty, Invention Disclosures And Gender By School Average Per Year 2000-2014.**

<b>A</b>				
<b>School of faculty</b>	<b>#</b>	<b>Faculty</b>		
		<b>% Female</b>	<b>% Male</b>	<b>% Inventors</b>
Medicine-UTL	393	23	77	24
Engineering	231	12	88	26
Medicine-MCL	397	30	70	8
H&S	533	27	73	5
Earth Sciences	48	21	79	7
Business	101	18	82	2
Education	50	43	57	4
Law	49	30	70	2
<b>Total</b>	<b>1802</b>	<b>25</b>	<b>75</b>	<b>12</b>

<b>B</b>			
<b>School of faculty</b>	<b>#</b>	<b>Faculty Inventors</b>	
		<b>% Female</b>	<b>% Male</b>
Medicine-UTL	323	20	80
Engineering	205	14	86
Medicine-MCL	186	18	82
H&S	112	15	85
Earth Sciences	18	22	78
Business	8	13	87
Education	7	43	57
Law	1	0	100
<b>Total</b>	<b>860</b>	<b>18</b>	<b>82</b>

<b>C</b>			
<b>School of faculty</b>	<b>#</b>	<b>Faculty Disclosure Events</b>	
		<b>% Female</b>	<b>% Male</b>
Medicine-UTL	2760	16	84
Engineering	1868	12	88
Medicine-MCL	694	17	83
H&S	624	8	92
Earth Sciences	34	32	68
Business	10	10	90
Education	14	21	79
Law	1	0	100
<b>Total</b>	<b>6005</b>	<b>14</b>	<b>86</b>

ure-line faculty from the School of Medicine (Medicine-UTL) and 205 (24 percent) were from the School of Engineering. Faculty from the School of Medicine in the MCL and faculty from the Schools of Humanities and Sciences (H&S), Earth Sciences, Business, Education and Law combined to make up the remaining 332 (38 percent of inventors) (Table 2B). Similarly, most of the 6005 disclosure events were from inventors in Medicine-UTL (n=2760, 46 percent of disclosure events) and Engineering (n=1868, 31 percent of disclosure events), while the remaining schools combined accounted for 1377 disclosure events (23 percent) (Table 2C).

To account for the gender differences among schools, we performed additional year-by-year analysis focused on the two schools with the most disclosure events—Medicine-UTL (Figure 2A) and Engineering (Figure 2B).

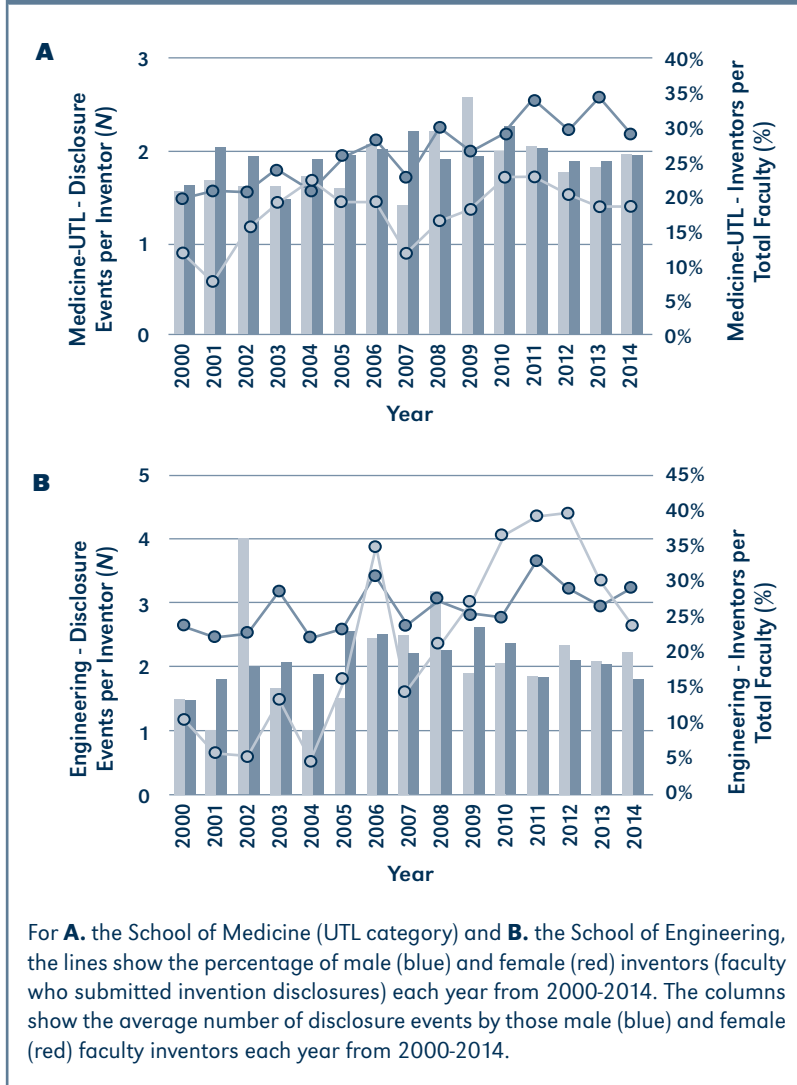
In Medicine-UTL the percentage of faculty per year who were inventors increased from 2000 to 2014 for both men (19 percent of faculty in 2000, 29 percent in 2014) and women (12 percent of faculty in 2000, 19 percent in 2014). For every year except for 2004, a higher percentage of male faculty than female faculty were inventors ( $p=0.09$ ; Chi Square). The number of disclosure events by those inventors also increased in this time period with male inventors averaging 1.63 of disclosure events in 2000 and 1.93 in 2014 and female inventors averaging 1.56 of disclosure events in 2000 and 1.96 in 2014. Male inventors averaged significantly more disclosure events than female inventors in nine out of the 15 years analyzed ( $p=0.003$ ; Chi Square).

In the School of Engineering, we found an increase in the percentage of male faculty who were inventors from 2000 (23 percent) to 2014 (29 percent). During this period, we found an even greater increase in the percentage of female faculty who were inventors, from 11 percent in 2000 to 24 percent in 2014. Disclosure events per inventor increased slightly in the School of Engineering for both males (1.47 per inventor in 2000 and 1.78 per inventor in 2014) and females (1.50 per inventor in 2000 and 2.22 per inventor in 2014). When comparing the female and male faculty disclosure events in Engineering, female faculty averaged more disclosure events per inventor than male inventors in eight out of the 15 years analyzed.

In this analysis, inventors from the Bioengineering department and their corresponding disclosure events were divided evenly between their two school affiliations (Medicine-UTL and Engineering) because the department is joint between the two schools. The inventor and disclosure event pattern for faculty in the Bioengineering department was similar to the School of Engineering. However, that data is not presented separately because of the small number of faculty. In 2014 there were 17 faculty, three women and 14 men; 71 percent had invented, three women and nine men.

Start-up Companies by Gender. In some cases, a disclosure event can lead to licensing and commercialization of that invention through a start-up company. From 2000-2014, Stanford licensed inventions to 123 start-up companies founded by faculty, representing approximately one faculty start-up for every 49 faculty disclosure events. Of these 123 companies, 110 (89 percent) had only male faculty founders and 13

**Figure 2. Annual Comparison Of Faculty Inventors And Faculty Disclosure Events In The School Of Medicine (UTL) And The School Of Engineering By Gender**



For **A.** the School of Medicine (UTL category) and **B.** the School of Engineering, the lines show the percentage of male (blue) and female (red) inventors (faculty who submitted invention disclosures) each year from 2000-2014. The columns show the average number of disclosure events by those male (blue) and female (red) faculty inventors each year from 2000-2014.

(11 percent) had at least one faculty founder who was female (Table 3).

When considering the license success rate of the faculty-founded start-up companies, at the time of this study, 93 of the 123 start-up companies (76 percent) continued to license the Stanford technology either as an active independent company (74) or through a company that acquired the original start-up (19); 30 companies no longer maintained a license, either because the company became defunct (18) or because the company terminated the license (12). Of these active and acquired companies, 85 (69 percent) had male faculty founders and eight (seven percent) had at least one female faculty founder and of the inactive companies, 25 (20 percent) had male faculty founders and five (four percent) had at least one female faculty founder ( $p=0.2$ ; Chi square) (Table 3).

Extrapolating from the average numbers of men and women faculty per year, it can be projected that a census of 1281 male faculty per year was associated with 68 active start-ups founded by male faculty during the study period while 369 female faculty per year led to six active start-ups founded by one or more female faculty. In other words, the cumulative effect of lower levels of female participation as inventors and entrepreneurs resulted in one active start up for every 18 male faculty compared to one active start up for every 61 female faculty. Stated in another way, it takes 3.4 times more female faculty to have one active start-up.

Start-up consulting, SAB, BOD and CEOs by Gender. After a start-up company is founded, Stanford faculty may remain involved in the company through three possible roles: consulting, becoming a member of the scientific advisory board (SAB), or becoming a member of the board of directors (BOD). Faculty founders may choose one or more of these roles provided they adhere to the university policy on conflicts of interests. Management roles such as CEO, CTO or CSO are

**Table 3. Gender Of Faculty Founder Of Start-ups Licensed 2000-2014.**

Gender of Founders	Status of Start-ups (N)				Total
	Active	Acquired	Defunct	Former	
All Male	68	17	14	11	110 (89%)
Any Female	6	2	4	1	13 (11%)
<b>Total</b>	<b>74</b>	<b>19</b>	<b>18</b>	<b>12</b>	<b>123</b>

Status Definitions: Active—company exists and continues to license the technology; Acquired—start-up acquired by another entity; Defunct—company no longer exists; Former—initially licensed the technology but later terminated the license.

**Table 4. Roles\* Of Faculty Founders In Active Start-ups As Of April 2015.**

Gender of Founders	Active Start-ups (N)	Board Participation			% of Active Start-ups with faculty founders in roles
		SAB/Consultant (# of companies)	BOD (# of companies)	None (# of companies)	
All Male	68	37	24	19	72%
Any Female	6	3	1	2	67%
<b>Total</b>	<b>74</b>	<b>40</b>	<b>25</b>	<b>21</b>	<b>72%</b>

Board Participation: SAB/Consultant—faculty participating on scientific advisory board and/or as a consultant for their active start-up; BOD—faculty participating on board of directors for their active start-up; None—faculty did not participate on any board or as a consultant for their active start-up. \*Some faculty participate in multiple roles.

not permitted unless the faculty member takes a leave of absence. Alternatively, the faculty founder may have no additional role in the company.

To examine how the gender of the faculty founder affects continuing involvement in the company, the 74 active start-ups were reviewed to determine faculty roles during the study period (Table 4). For this analysis, consulting and SAB membership were combined in one category since SAB members are considered consultants.

Overall, the active companies founded by male faculty had more of the founding faculty participating in a consulting or board role at the time we performed the analysis than active companies founded by female faculty. The gender discrepancy was greater with respect to BODs than SABs: 35 percent (24/68) of male-founded companies vs. 17 percent (1/6) of these companies

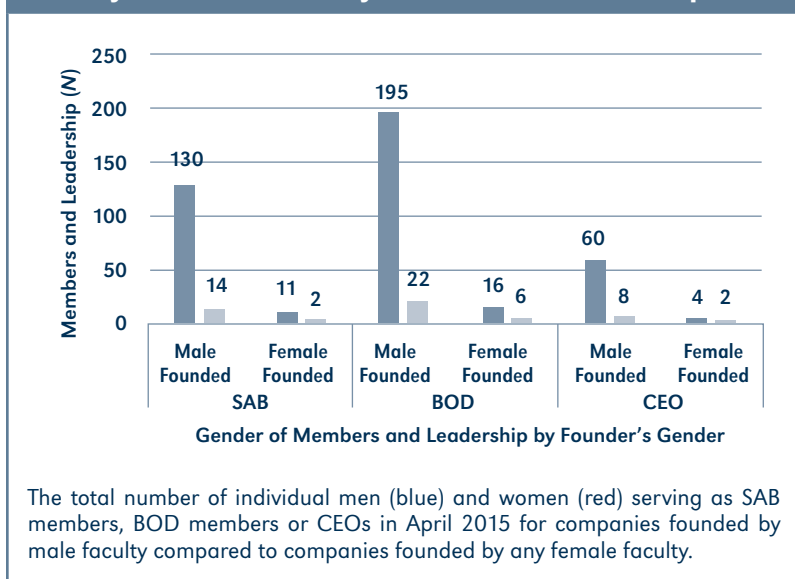
with any female founders had faculty as BOD members. In contrast, 54 percent (37/68) of male-founded companies and 50 percent (3/6) of companies with any female founders had faculty serving as SAB members or consultants, indicating that these roles are less determined by founding faculty gender than is the case for BOD membership.

For a more comprehensive overview of how the gender of faculty founders may influence the overall gender composition of the boards and management of start-ups, we examined the gender of the CEO and board membership for the active companies (Figure 3). For this analysis, we included faculty board and consulting participation in the total number of people represented in each category. Based on the information available during the study period, male-founded companies had significantly lower numbers of women participants in all three roles. In aggregate for male-founded companies, only 10 percent (14/144) of the SAB members, 10 percent (22/217) of BOD members and 12 percent (8/68) of CEOs were women. In comparison, for companies founded by at least one female, 15 percent (2/13) of SAB, 27 percent (6/22) of BOD members and 33 percent (2/6) of CEOs were women, with the caveat that there were only six active companies founded by at least one woman.

## Discussion

Innovation and entrepreneurship activities of university faculty can be investigated by assessing various stages of commercialization including invention disclosures, patenting, start-up company formation, and participation in company boards and leadership roles. This analysis comparing invention disclosures and start-up company

**Figure 3. Gender Of SAB/BOD Members And Leadership By Gender Of Faculty-Founded Active Start-ups**



activity by women and men faculty provides insights about trends over the period from 2000-2014 at a major U.S. research university. As expected, most disclosures were made by Stanford faculty in the Schools of Medicine and Engineering. Overall, men faculty submitted six times more invention disclosures than women faculty during this interval. However, the disclosure discrepancy between men and women faculty could be changing. Based on the first eight years studied, men had eight times more disclosures than women, while in the most recent seven years studied, men disclosed only five times more than women. Of interest, applying these measures to the School of Engineering faculty showed no significant differences between women and men in the most recent period. Most of the invention disclosures by School of Medicine faculty were made by those in the tenure line; significantly more men than women in the tenure line made invention disclosures.

Our study adds to the information provided from previous reports by considering the founder stage when looking at the continuum from patenting to new company formation to board and leadership roles. In addition, previous studies of SAB participation rates were limited to the life sciences and focused on the likelihood of whether faculty members participated in SABs. They did not systematically study whether University-associated companies had women on their BODs or as CEOs and whether the gender of the founders influenced the gender of the board and leadership roles.

When the focus was on gender differences related to patenting, Ding (2006) found that women faculty in life sciences received patents at about 40 percent the rate of men, with 5.65 percent of female faculty and 13 percent of male faculty obtaining patents related to their research discoveries. Further, women were listed as the primary inventor on fewer than eight percent of United States patents, according to an analysis conducted by the Institute for Women's Policy Research (2016).

We found that only 11 percent of start-up companies that licensed university IP had a female founder. When the start-ups were categorized by viability, start-ups that maintained active licenses were even less likely to have female faculty founders and start-ups that dissolved during the study period were more likely to have women faculty founders. However, this difference was not statistically significant and the numbers were necessarily small because very few women faculty founded companies. The gender composition of SABs/Consultants, BODs and CEOs of faculty-founded companies was also predominantly male and particularly when the company had all male founders. Thus, while there is an increase of participation by women in the first step of engagement with technology transfer,

which is the disclosure of their inventions, their involvement with start-up companies and in leadership roles among companies licensing university-generated intellectual property remains limited even in recent years.

The Association of University Technology Managers (AUTM) created the Women Inventors Committee (WIC) in 2013 to generate ideas and implement changes to increase the participation of women in innovation. WIC identified several innovation barriers for women faculty, including gender bias, lack of confidence and multiple time commitments (Baker 2015). Lafrance (2016) concluded that the lack of patent activity likely restricted opportunities for women as other studies have found that venture capital is attracted by patent ownership and men were four times as likely as women to receive venture capital.

With regard to involvement with company leadership, the evidence indicates that women are simply not invited to participate (McCook 2013). Since faculty founders of companies have the opportunity to serve as members of BODs for companies that license inventions from their university research, the fact that women found fewer companies contributes to their significant under-representation on the boards of such companies. Ding (2013) examined the gender difference in the likelihood that men and women academic scientists will join SABs, looking at the demand-and supply-side theories of SAB invitations and the preference of the scientist for this type of work. The study showed no evidence of a choice-based explanation for the gender gap; rather, gender-stereotyped perceptions and unequal opportunities rooted in social networks appeared to explain the discrepancy (Ding 2013). Further, Ding (2013) found that in the life sciences, male scientists were twice as likely as females to serve on SABs and the cause was lack of invitation not lack of time.

As our study shows, tracking done within the technology transfer office is a method for universities to identify gender disparities in how the faculty engage with invention disclosures and participation in start-up companies. More information about these patterns is needed because entrepreneurship activity by women constitutes an economic issue not a gender issue (Mitchell/Kauffman Foundation 2011). Assessment of current patterns and prospective monitoring by research institutions should facilitate data-driven, targeted strategies appropriate for the local environment which will encourage participation by women in the transfer of university research for further development, so that the public benefits of discoveries made by women faculty are realized through commercialization. ■

Available at Social Science Research Network (SSRN):  
<https://ssrn.com/abstract=3103214>

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## References

Baker, J. & Mercier, N. (2015). "Realizing Potential: Keys To Nurturing Female-Led Innovation." *Technology Transfer Tactics*, 9 (5), 65-80.

Ding, W., Murray, F., & Stuart, T. (2006). "Gender Differences in Patenting in the Academic Life Sciences." *Science*, 665-667.

Ding, W., Murray, F., & Stuart, T. (2013). "From Bench to Board: Gender Differences in University Scientists' Participation in Corporate Scientific Advisory Boards." *Academy of Management Journal*, 1443-1464.

Falkenheim, J. & Hale, K. (2015). "Women, Minorities, and Persons with Disabilities in Science and Engineering." *National Center for Science and Engineering Statistics*, 1-21.

Jensen, R. & Jones, M. (2011). "University Start-ups and Entrepreneurship: New Data, New Results." No 9, Working Papers from University of Notre Dame, Department of Economics, 1-31.

LaFrance, A. (2016). "Why do women inventors hold so few patents?" *Atlantic*, 1-4.

McCook, A. (2013). "Women in biotechnology: Barred from the boardroom." *Nature*, 25-27.

Milli, J., Gault, B., Williams-Baron, E., Xia, J., & Berlan, M. (2016). "Where are the Women Patent Holders?" Institute for Women's Policy Research, 1-10.

Nager, A., Hart, D., Ezell, S., & Atkinson, R. (2016). "The Demographics of Innovation in the United States." Information Technology & Innovation Foundation, 1-86.