



# Influences on the Entrepreneurial Activities of Women Academics

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## Abstract

There has been a sustained research activity in investigating academic entrepreneurship. However, the research investigating the entrepreneurship of academic women has received limited attention. This paper investigates the influences on the entrepreneurial activities of women academics by conducting a literature review. Individual and educational background factors, such as management education, human capital, as well as being in a senior faculty position affects the entrepreneurial propensity of female academics in a positive way, while age and institute directorships have a negative influence on entrepreneurship. However, an equal distribution of professorship, of a selection of specific disciplines, such as engineering or physical science, and of previous business experience would contribute to close the gender gap and would be a catalyst for women academics to become entrepreneurs. Our paper fills the research gap on systematizing the research on factors that influence entrepreneurial activities of female academics and shows that entrepreneurship of females working in academia result from a gender-based discrimination.

## Introduction

Over the last decades, there has been an increasing interest in studying the entrepreneurial behavior [1-3]. A reason for this interest can be seen in the huge contribution of entrepreneurship to economic and societal development [4,5]. Although in studies the academic entrepreneurial behavior was investigated [6-13], there are only a few studies predicting the entrepreneurial behavior of female academics. The overall purpose of this study is thus to investigate the influences on entrepreneurial activities of women academics based on a literature review. We present an overview of literature that relates to systematic literature reviews of studies explaining entrepreneurial activities of scientists at universities. After an initial overview of the related work, we examine specific prior work on the influences on the entrepreneurial activities of women academics at universities.

## Literature Review

A review undertaken of 66 studies published between 2007 and 2018 looking at the influences on academic entrepreneurship intentions of scientists has shown that three factors of influences emerge from the studies: individual, organizational, and institutional variables [14]. Following the Theory of Planned

Behavior (TPB) the intention is a predictor of the action [15]. The individual variables, that exert a significant positive influence on the academic entrepreneurial intentions in all reviewed studies, are the following: the

- a. Demographic background including gender and family background
- b. The educational background with the academic status
- c. The motivations including the expectations that academic engagement will enhance career success, the academic recognition expectations, the risk-taking propensity, the joy, the challenge, the curiosity, and the moral duty
- d. The social capital including professional and personal networks and
- e. The human capital with the patenting experience and the entrepreneurial abilities [14].

For the influencing organizational variables, [14] found in their review the quality of the university and the department quality. The influencing institutional-level factors include the research type

of the scientific discipline [14]. In terms of the influential system and state, that the push factors are “multiple”, “context dependent”, “hierarchy dependent”, “heterogeneous”, “dependent on each other and against each other” which makes the system even more complex and dynamic [16] refer to a systematization widely used in the university entrepreneurship literature: They suggest three levels of influence factors: university-wide organizational issues, department-level influences including the work environment of scientists within their faculty and finally personal influences at the level of the individual scientist.

For the factors of the university organizations, the university administration attitudes, the encouragement from university, the university’s active support and the intensity of industry collaboration exert an influence on scientists’ entrepreneurial intentions [16]. Regarding the department and work environment, the faculty peer approval, the peer entrepreneurial activity and the research group support seem to exert a positive influence on the entrepreneurial intentions [16]. The individual influences of the scientists relate to the entrepreneurial self-identity, the degree of freedom at work, the opportunity costs of founding, the benefits of commercialization and prior entrepreneurial experience. Following the systematic literature review conducted for reviewed 193 articles published between 2000 and 2019, the influences of the academic spin-offs refer to micro-, meso- and macro-level factors.

The micro-level factors address the influences of the individual, and include the following:

- a) The intrinsic motivation (e.g., inner satisfaction, and self-realization),
- b) The extrinsic motivation (e.g., grants, academic recognition, reputation and promotion),
- c) Human capital (e.g., prior commercial and entrepreneurial experience, prior industrial work experience, business management experience, and domain-specific research experience),
- d) Social capital (e.g., professional, personal and business social networks),

e) The psychological factors (e.g., attitudes, perceived behavioral control and social norms according to the theory of planned behavior, hybrid role identity with a focal academic self and a secondary commercial persona, the entrepreneurial self-efficacy (ESE), promotion focus for striving to achieve positive goals according to the regulatory focus theory,

f) Personality and demographic characteristics (e.g., extraversion, emotional stability, openness to experience, age, gender, career status and seniority, and

g) Faculty quality, research types and disciplines (diverse and balanced skillsets, applied research, and science, engineering and physics disciplines [17].

The meso-level influencing factors of the organization of the university refer to the university characteristics with the elements of applied research, prior industry cooperation experiences, solid resource bases, reputation and university prestige, the entrepreneurial orientations including the entrepreneurial culture and climate within the university and the departments, and) the support mechanisms with the university regulations, incubation services, financial support and entrepreneurship education [17]. The macro-level factors consist of the social-economic environment, like the contextual factors [17]. Drivers for the academic spin-offs at the macro-level are for the regional context the level of economic development, culture and histories, geographical location and the entrepreneurial environment and for the national context the government instruments, regulations and the support programs [17].

In sum, the study in this field relates to the predictors of academic entrepreneurship independently of gender. However, some attempts have been made to address this issue. We will present these research studies grouped according to the following categories:

- a) Studies including gender as explanatory variable
- b) Studies including separate regressions for females and males

**Table 1:** Impact of gender on academic entrepreneurship.

Authors/Year	Sample	Impact
Abreu & Grinevich [18]	UK academics (2008–2009)	Negative: Spinout activity (Gender: female):
Aldridge & Audretsch [22]	United States-based scientists awarded a research grant by the National Cancer Institute between 1998 and 2002 to commercialize their research. Of those research grant awards the largest 20%	Non-significant
Alshumaimri, Aldridge, & Audretsch [20]	Scientists selected randomly from three universities in Saudi Arabia: King Abdulaziz University, King Fahad University and King Saud University	Non-significant
Bijedic [21]	Academic scientists in 73 German universities	Negative (Gender: female)

Dohse, Goel, & Göktepe-Hultén [7] Krabel & Müller [10]	Researchers at the Max Planck Society (MPS) at different career stages in Germany	<ul style="list-style-type: none"> <li>- Negative: Business Owner (Gender: female)</li> <li>- Non-significant: Nascent Entrepreneurs</li> <li>- Non-significant: Nascent Entrepreneurs</li> </ul>
Goel, Göktepe-Hultén & Ram [26]	Researchers at the Max Planck Society (MPS) at different career stages in Germany	<ul style="list-style-type: none"> <li>- Negative: Academic business start-ups (Gender: female)</li> </ul>

Studies including gender as explanatory variable (Table 1): Using data from a survey conducted in 2008–2009 with 22,556 UK academics, [18] found that among the personal characteristics of the respondents, such as gender, academic position, type of research, academic discipline (health sciences, biological sciences, engineering and physical sciences, social sciences, business and media, humanities, creative arts, or education), affiliation with Russell Group research-intensive university, business experience, network participant, perceived constraints and ethical/moral views of research commercialization, and academic entrepreneurship, gender exerts a marginal significant negative impact on the spinout activity of academics [18].

Based on a data base of 1,693 high profile scientists receiving large-scale funding from the National Cancer Institute, [19] found that out of the variables of age, gender, human and social capital, institutional influences, financial resources, being male has no significant impact on the propensity for the scientist to become an entrepreneur [19] and found for 288 scientists of three universities in Saudi Arabia that out of the variables of experience, gender, social capital, human capital, and university and other institutional policies encouraging commercialization activities, the coefficient on the dummy variable indicating gender is not statistically significant. This means that male scientists are not more likely to be nascent entrepreneurs [20]. With focus on the overall academic entrepreneurship at German universities, a study was conducted [21] including gender as an independent variable [21]. studied the individual and structural influences on the entrepreneurial activities of scientists in German universities based on data of the Institut für Mittelstandsforschung (ifm) in Bonn, Germany [21] found that personal factors such as being male, middle-aged and being of non-German nationality with entrepreneurial parents or partner promote the entrepreneurial activities of scientists in German universities using data of 5,992 academic scientists in 73 German universities.

Based on 2,604 completed interviews out of a total sample population of 7,808 researchers at the Max Planck Society (MPS) in Germany at different career stages. [22] found, that out of the variables of age, and gender, academic discipline, industry interactions, patents, educational background, citizenship, being female has a significant negative impact on business ownership of researchers, while its impact on nascent entrepreneurs is non-significant [23]. The definition of nascent entrepreneurs is based on the classification of the Global Entrepreneurship Monitor: "Thus, scientists were classified as nascent entrepreneurs if they were engaged in any activity associated with starting a business

on the day of the interview. These activities may include applying for public or private financing, seeking venture capital, writing a business plan, looking for office space, or forming the founding team" [23]. "Business ownership, by contrast, indicates that a person has created a sustainable venture that is able to survive in the long run." [9,7,11] also run regressions for the whole sample of men and women. Based on survey data of 2,004 interviews from a large public research organization, German institutes of the Max Planck Society (MPS), among the variables of age, and gender, academic discipline, industry interactions, industrial experience, patents, educational background, citizenship, commercialization attitudes, perceptions about attractiveness of entrepreneurship, accessibility of research being female has a significant negative impact on academic business start-ups [20].

Studies including separate regressions for females and males: We give a tabular summary with the predictors of women's academics entrepreneurship (Table 2). Conducted a study of this type for researchers at a non-profit research organization to predict entrepreneurial propensity. Compared to the male researchers for the females age has a slightly negative impact, and industrial experience has a positive effect on entrepreneurial activities of females [23]. Perceiving an increased reputation from academic entrepreneurship increases the entrepreneurial probability of female and male academics. Patenting history impacts significantly the male activities, while for the females the influences is insignificant [23]. Regarding the organizational factors (Table 3) the institute directorship has a strong negative impact on the entrepreneurial propensity of females while it is positive for males [23]. Studied, how institutional structures in and around university-based incubators are predictors of women becoming incubator entrepreneurs. University incubators as entities that are often funded by tax money have the function to accelerate entrepreneurship through business support [24]. Based on data of over 1,400 venture projects in 19 Swedish incubators, the authors applied multi-level logistic regression analysis to examine 793 new venture incubators projects [24]. They found, that on university level, a higher proportion of female faculty in senior positions increase the likelihood of a female-led incubator project [24]. As for the institutional factors (Table 4) and specifically the incubator-led projects, the presence of a female on the incubator's board of directors exerts a positive influence on becoming incubators entrepreneurs, while the incubator age has no significant impact [24]. Neither the proportion of female led start-ups in the region nor the number of start-ups per 1000 inhabitants exerts an influence on becoming incubator entrepreneurs [24]. That the females choose more often than men research areas closely linked to the public and

not-for-profit sectors [25], corresponds with the motives of female academic entrepreneurs. Following the explorative qualitative study conducted [5], female academics are driven by the ideals of creating services or products for the common good and making a social difference.

**Table 2:** Individual and educational background effect by academic entrepreneurship of females.

Individual and Educational Background	
- Age	Negative [27]
- Perception of increased reputation from academic entrepreneurship	Positive [27]
- Management education	Positive Ebersberg and Pirhofer
- Patenting history	Non-significant [7]
- Industrial experience	Positive [7]

**Table 3:** Organizational background effect by academic entrepreneurship of females.

University context	
Institute directorship	Negative [17]
Female faculty in senior positions	Positive effect on becoming incubator entrepreneurs [20]
Size of university	Non-significant effect on becoming incubator entrepreneurs [20]

**Table 4:** Institutional background effect by academic entrepreneurship of females.

Incubator	
- Leadership: the presence of a female on the incubator's board of directors	Positive effect on becoming incubator entrepreneurs [20]
- Incubator age	Non-significant on becoming incubator entrepreneurs [20]
Context	
Proportion of female led start-ups in the region	Non-significant on becoming incubator entrepreneurs [20]
Number of start-ups per 1000 inhabitants	Non-significant on becoming incubator entrepreneurs [20]

## Results

Summarizing the individual variables that explain academic entrepreneurship in general, we can categorize two types of individual factors socio-demographic factors, such as for example age and gender; and) psychographic factors, such as traits, attitudes, perceived action control, abilities and experience [26-32]. The organizational variables differ in terms of industrial collaboration of the university, peer effects, organizational support, commercialization experience of the university organizational climate of the chair, and the excellence initiative reflecting the quality of a department resp. the university [11,22,15]. On institutional level, the type of the discipline, the entrepreneurial-related policy, and the population development influence the entrepreneurial activities of scientists [2,4,18]. Regarding the results in terms of the impact of gender on academic entrepreneurship, the evidence is equivocal in terms of the impact of gender on the academic entrepreneurship.

Summarizing these studies including separate regressions for men and women, we conclude that management education, human capital, as well as being in a senior faculty position have a positive impact on the entrepreneurial propensity of female academics, while age and institute directorships interact negatively with entrepreneurship. Using a nonparametric decomposition analysis, found that the majority of the statistically significant gender gap in spinout activity can be explained by differences in the values of the explanatory variables such as for example seniority, type of research, discipline, and experience. These attributes that are typical for male academics and promote spinout activities characterize a minority of female academics. "The Blinder-Oaxaca decomposition shows that 61% of this gap can be explained by differences in the endowments, meaning that if female academics had the average attributes of the male academics in the sample, the gender gap would close by this amount [30]." In addition to this component, the differences in the behavioral responses of female academics to those attributes explain the gender gap.

This “unexplained component” might be interpreted in part as the gender-based discrimination and represents “the degree to which the gap would close if the female academics in the sample had the coefficients of the male academics” and demonstrated the gender gap in academic entrepreneurship, meaning, that both the values of the explanatory variables and the effects of those variables on academic entrepreneurship are different between female and male academics and these results have been affected by selection bias [20]. Referring to the decomposition for individual variables, the values of the explanatory variables that explain the greatest proportions of the gender gap are “whether the individual is a professor (14%), academic discipline, particularly engineering and the physical sciences (14%), and whether the individual has previous experience in starting or running a small business (23%).” The authors conclude, for example in case of professorship, that, if the probability for the female and male average academic to become professor was the same, the gap would close by 14%. The huge effect of the previous business experience shows that the missing one is a huge barrier for entrepreneurial activities.

## Discussion

With this study, we contribute to systematize the knowledge of the research of influencing factors of entrepreneurial activities of women academics. While the results of the impact of gender on entrepreneurial activities of academics are ambiguous, the individual and educational background factors, such as management education, human capital, as well as being in a senior faculty position affects the entrepreneurial propensity of female academics in a positive way. Age and institute directorships however have a negative influence on entrepreneurship. Interestingly, using a nonparametric decomposition analysis, found that the majority of the statistically significant gender gap in spinout activity can be explained by differences in the values of the explanatory variables such as for example seniority, type of research, discipline, and experience. These attributes that are typical for male academics and promote spinout activities characterize a minority of female academics. “The Blinder-Oaxaca decomposition shows that 61% of this gap can be explained by differences in the endowments, meaning that if female academics had the average attributes of the male academics in the sample, the gender gap would close by this amount.” In addition to this component, the differences in the behavioral responses of female academics to those attributes explain the gender gap.

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