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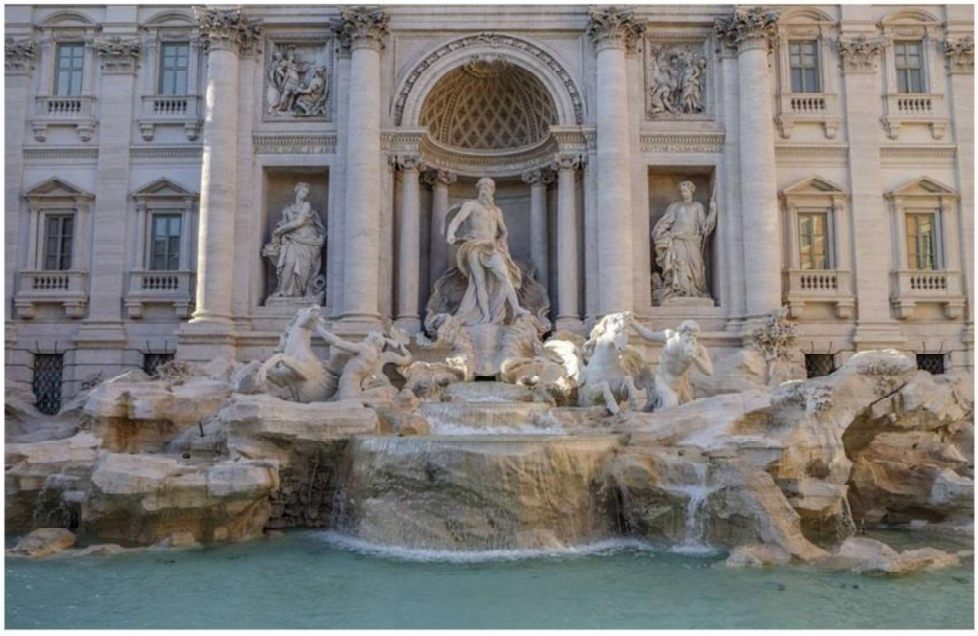

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Gender and Research Productivity of Academics in South India's Higher Education Institutions

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Abstract: Conducting and publishing research is a very important aspect of any Higher Education System. In India, despite the rapid increase in the number of Higher Education Institutions (HEIs), students and staff, very few studies have been conducted investigating how various factors influence academics' Research Productivity (RP), especially exploring the gender differences in RP. Thus, this research aims to quantitatively and qualitatively explore the gender differences in RP and the factors influencing them. The quantitative results showed overall little differences in RP based on gender, whereas the interviews revealed a rich data on the various issues and the pressures female academics are under whilst conducting research. The inequity in terms of opportunities, ability and resources available were seen to be the major influencing factors. The research will be useful in formulating policies to decrease the inequities and increase the opportunities for the female academics to conduct research, especially considering the rapidly changing academic environment and the increasingly important role female academics play in Higher Education (HE) in India.

Keywords: research productivity, higher education, gender, research policies, cultural factors

1. Introduction

Academics are the key resource and means of RP and also play a pivotal role in the HEI achieving its objectives in teaching, research and its wider social contribution (Machado-Taylor et al., 2014; Machado-Taylor et al., 2011). As RP being seen as one of the crucial elements for promotion, pay rises, securing funds and also for institutional ranking and obtaining research grants etc. (Garwe, 2015 ; Ogbogu, 2009; Chen et al., 2006; Carayol and Matt, 2006; Ramsden, 1994), it is important to identify the various factors influencing both positively and negatively academics' RP .

2. Theoretical background

Research Productivity (RP) is a measure of conducting and publishing research (Abramo and D'Angelo, 2014; Hirsch, 2005; Zamarripa, 1993; Ramsden, 1994). As Fox (1983) points out, any research activity becomes tangible only when it is disseminated by publication or its equivalent, with publishing and sharing results being the fundamental social interaction in academia. RP is an accumulation of different research activities including: publishing papers at national and international levels, books, chapters, monographs, newspaper articles, securing grants, supervising research students, serving as a peer reviewer, being an editorial board member, offering presentations, lectures as a guest speaker, contributing to national and/or international level committees, filing patents etc. (Wootton, 2013).

There are several complex factors influencing academics' RP (Ramesh Babu & Singh, 1998). This is evident from the works of Subramanian and Nammalvar (2017), Times Higher Education (2016), Jasmine et al. (2011), Smeby and Try (2005), Prpic (2002), Bonaccorsi and Daraio (2002), Sax et al. (2002), Clark et al. (1996), and Allison and Stewart (1974), among others, who point out factors such as demographics, the type of institution they work in, the size of the research group, the research culture and environment, the presence of international post-docs, colleagues' research work etc. influencing academics' RP.

The influence of demographic factors such as age, staff qualifications and composition of the academic staff have been studied but with differing results (See Adams and Clemmons, 2009, Abbott and Doucouliagos, 2004, Dundar and Lewis, 1998, and Ramsden, 1994). Among the demographics, focusing on gender, several researches have pointed out the considerable differences in academics' RP, with female academics having fewer

publications, having lower h-index and a network of smaller co-authors compared to male academics and, consequently, influencing them progressing to senior academic positions within the institutions (See Warner et al., 2017, Holliday et al., 2014, and Hill et al., 2015). For instance, Prpic (2002) reports that young female academics publish an average of two papers less than their male counterparts early in their career. But as the number of years of experience increases, there are little differences in academics' RP (Hill et al., 2015).

Aksnes et al. (2011) report that, for all age groups, male academics were more productive than female academics. However, in a later research, Rørstad and Aksnes (2015) comment that men publish more than women only until the age of 55 to 59, after which women have a higher publication rate. They also maintain that the position held in the institution is a better reflection of RP than gender or age group. Even though several research studies point out that male academics publish more than female academics, in terms of job satisfaction, female academics are seen to be more satisfied with their job compared to male (Smeby & Try, 2005; Katoch, 2012, Karthik & Velavan, 2012).

Looking at the reasons for the differences in RP, Hunter and Leahey (2010) and Kyvik and Teigen (1996) comment that women academics having young children and a lack of research collaboration are two of the major reasons for them to have lower RP. This is supported by the works of Richards (2006), who reports that motherhood was associated with difficulties in career advancement for female assistant professors, whereas male academics were not reported to have these issues, with married men and those with children advancing quicker than single or men with no children. Under-representation of female academics, especially in Science, Technology, Engineering and Mathematics (STEM) subjects is seen to be another reason for their lower RP. It is common across most nations to have gender inequality in STEM, with male members being more than female members, with India being no exception (Gupta & Sharma, 2002). This shortage of role models might also influence the research output of female academics.

Be it so in other countries, very few studies have been conducted in the Indian academic system regarding RP based on gender differences. This study aims to add to the discussion on the influence of gender on RP by studying engineering academics in south India's HEIs. Briefly introducing the rapidly expanding Indian HE system, from 2000 to 2017 alone, there has been an increase of 205% in the number of HEIs, a 269% increase in the number of academics and a 311% increase in the number of enrolled students (UGC, 2017), showing the rapid expansion of HEIs. Currently, there are more than 35.7 million students enrolled in HE (AISHE, 2017), showing the enormity of the sector. By 2020, India will be the second largest country overtaking the United States in terms of students enrolling in HE (British Council, 2012). Furthermore, by 2025, India is expected to have the world's largest student-aged population (Oxford, 2017), thus showing the future projections. Looking at the academics in HEIs, totally, there are more than 1.3 million HE academics, out of whom 59.4% are male and 40.6% are female (AISHE, 2017). Having 40.6% of female academics is much more equitable compared with other countries where the number of female academics is less than 20%. It also shows the importance of identifying and understanding the various factors influencing the different genders to conduct research and to publish. In addition, Paul et al. (2015) comments that studying academics' RP is a new area in India, strengthening the need for this research.

Bakthavatchaalam (2018), in his review of papers written from 1990 to 2017, found only 37 empirical papers that were written on Indian academics' RP. It is surprising that so little research has been conducted in the rapidly developing country of India and its expanding HE sector. Along with identifying several gaps in the literature, the review identified that, among these 37 papers, very few have explicitly looked at the differences in genders' RP, that too with differing results, thus emphasising the need for research to be conducted to understand the differences in the male and female academics' RP and the various factors influencing them. To do so, this paper will focus on RP of the academics in engineering HEIs of South India. This is the first study to explore RP of South India's engineering academics, specifically looking through the lens of gender differences, thus adding to the current literature and discussion.

This research identifies the factors influencing RP of both male and female academics and seeks to qualitatively understand how gender differences influence academics' RP.

3. Methodology

A mixed method approach was chosen so as to both quantify the various factors influencing academic genders' RP and also to understand the 'why' and 'how' these factors influence RP (Halcomb & Hickman, 2015; Watkins, 2015; Egbert & Sanden, 2013; Lund, 2012). The engineering institutions in Coimbatore were selected as the target population. Coimbatore is one of the big cities in South India and has more than 60 engineering HEIs founded over the years. The current research focuses on those institutions started after 1990. For quantitative data, a total of 624 questionnaires were handed to the academics by visiting the institutions. After two follow-ups, the total responses were 420, with a response rate of 67%. After discarding partially filled and illegible responses, a total of 307 questionnaires were used for quantitative analysis. Tests of association and differences were conducted, and standardised scores were used to compare the genders. Semi-structured interviews were used for collecting qualitative data. In total, 14 interviews were conducted. Interviewees include nine academics and five managers. There were five female interviewees in total, three from the academic level and two from the management level. Content analysis was used for analysing the data from the interviews.

For quantifying academics' RP, even though several schemes for scoring each of the Elements of Research Productivity (EoRP) are available (see Horodnic & Zait, 2015: Caminiti et al., 2015; Gibson et al., 2015; Wootton, 2013), this research uses the Academic Performance Indicators (API) scoring system, which is a centralised national level scoring system in India developed by the Government (NIRF, 2015). In this system, each of the EoRP is ascribed a particular score, which are then summed up to find the Overall Research Productivity (ORP) score. API was selected as most of Indian HEIs have started to follow this and that it is expected to be centralised across the nation. This research measures ORP as a summation of the last five year's Overall Supervision Score (OSS), Overall Conference Score (OCS) and Overall Paper Score (OPS). OSS is measured by the number of post-graduate and doctoral students supervised, OCS by the number of national and international conference presentations and OPS by the number of papers published in national and international journals.

4. Findings and discussion

The respondents' gender ratio was 65% male, 35% female, 46% single and 54% married. The respondents were mostly young professionals, with 81.1% of them being 35 years old or less and 95% of them were below 45 years old. 52% of them had less than five years of teaching experience and 84.7% of them had less than 10 years of teaching experience. The low number of older respondents reflects the actual demographics of the age group in Coimbatore's engineering HEIs, which has much more young academics.

The quantitative results show that the academics' ORP is very low, with very few academics conducting research and publishing, and with most of them having little to no research productivity. This contrasts with the nation's ambitions to become a research powerhouse in Asia. Exploring the possible reasons for the low RP, Altbach (2015) points out that most of the HEIs in the developing countries are teaching institutions and not research institutions. This is the scenario in India as well, with most of the institutions focusing on teaching. However, currently, there is a shift on the emphasis in Indian institutions from teaching to research, and they are trying to become knowledge hubs. This change in the emphasis can be seen from the introduction of the National University Rankings, API scores, etc., in which research is given considerable importance (NIRF, 2015).

Looking at the male and female academics' ORP, Table 1 shows no difference in their ORP. Looking at the constituents of ORP, there were no differences in their OCS, whereas males scored higher than female in the supervision of students (OSS: 4.597**) and for publishing papers (OPS: 9.309*). Whereas gender does not influence OCS, overall, the results show no difference in the ORP of both male and female, which can be seen from their mean ranks and the $\chi 2$ test ($\chi 2$ (1) = 10,445.5, P=0.993). This is similar to the results obtained by Vuong et al. (2017), Gonzalez-Brambila and Veloso (2007) and Bland et al. (2005), who, in their quantitative works, found no difference in RP between genders. However, these results contradict the conclusions of the works by Subramanian and Nammalvar (2017), Kyvik and Teigen (1996) and Aksnes et al. (2011), who suggest that there are gender differences in RP. It should be noted that among the above studies only the one by Subramanian and Nammalvar (2017) was conducted with Indian academics.

There were also no differences in the time spent by both the genders in teaching, research and administrative duties, with both spending approximately 60% of their time teaching and engaged in teaching-related duties, 10% of their time on research-related duties and the other 30% on administrative duties.

Table 1: Mann – Whitney U test of the difference in ORP between male and female academics

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of OVERALL_RESEARCH_PRODUCTIVITY_SCORE is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.939	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

The results also show that married academics in both the genders were more productive in their ORP, OCS, OSS and OPS compared to their single counterparts. This is almost certainly because single academics are generally younger compared to their married fellow academics and that the single academics are in the early stages of their carrier. Regarding the academics' age group, both the genders show an increased ORP as the age of the academic increases. A similar trend of increasing OSS, OCS and OPS was seen. There was no statistical difference in genders' RP at different age groups as well. Similar to the result from this research, Vuong et al. (2017) show an increase in RP with age, with RP being low in the initial stages of the academics' career and increasing from then on.

Looking at the quantitative results, it is surprising that there are no differences in genders' RP, as they contradict the works of several authors who found a substantial difference in RP between genders. Attributes such as parenting and bringing up the children, which Ogbogu (2009) and Hunter and Leahey (2010) found to influence RP, in this research quantitatively this is not seen to affect RP. Even though the quantitative analysis did not show any differences in genders' RP, the interviews revealed a range of differences, such as the absence of institutional support, colleague/research environment, and cultural factors influencing their RP. As one of the female respondents stated, "*There are definitely differences between the factors influencing male and female academics conducting research*".

Even though half of the male respondents acknowledge the existence of some difficulties for the female academics, the other half did not feel that there were any differences between the genders. Most of the male respondents commented that they were not completely aware of the various factors affecting female academics' RP. The female respondents commented that conducting research is more difficult for a female compared to a male academic, especially in an Indian context, and that female academics face more problems than their male counterparts, as explained by a female academic: "*Especially for a woman – they must go through the emotions of being a wife, of being pregnant, teaching and in addition they also must go through these emotions of an unsupportive supervisor*".

The female academics commented that there is a huge absence of institutional support for female academics to conduct research. This includes access to laboratory facilities during working time, receiving support for attending development programmes and flexible teaching hours to support their research activities. The academics commented that while male academics could choose to stay after working hours and access the library or the lab facilities, female academics cannot do that as they must go home and to attend family duties. This point was repeated several times by the female academics, connecting their lower RP to the unsupportive institutional policies and the Indian culture, where traditionally women dominantly take on the caretaking of the family. One female academic sustains that "*India being a more traditional country, taking care of the family, the children, the elderly and the chores usually fall on women. So, it is very difficult for them* [female academics] *to pursue a research career even if they want to. This is not so much of a problem for the male academics*".

They also commented that, currently, there is a lack of support mechanisms and models that take into consideration the gender differences for female academics in conducting research and in increasing their RP, especially having models that support those academics with young children. They further commented that having a full teaching load whilst being research active also hampers their RP and that the family responsibilities do not allow them to conduct research or prepare for teaching at home during the evenings, which is not much of a concern for the male academics. One of the suggestions that were pointed out includes lowering the teaching or the administrative loads for female academics conducting research.

Further research should be conducted that would squarely focus on and that would qualitatively explore the difficulties faced by the female academics and how the HEIs' research policies can counteract them.

A discussion should be promoted about the cultural factors, exploring how the marital status of the genders influences the ORP of the academics; being aware that females get married younger than male in India, which in turn influences their RP, as marriage adds more family responsibilities to female. A very interesting observation was how wanting a better husband or wife influences an academics' decision to pursue a research degree and how decisions on marriage affect the decision of the female academics, in particular, to start conducting a research degree, such as a PhD. A female academic comments that "*In India, arranged marriages are the norm. Women prefer not to do a PhD before marriage as the husband likes to have a higher degree than the wife. The man, however, starts a PhD so that he gets a better-arranged marriage*".

This result, albeit interesting from a research point of view, shows how marriage and cultural factors influence academics' RP. Models to improve RP that are based on western academics do not take into consideration such cultural nuances. This also means that the current models and the future models developed should take into consideration cultural factors and any indigenous factors that influence RP, rather than blindly following models developed in a different culture and country. A future study that looks at the influence of indigenous factors on academics' and of genders' RP would reveal rich data. Also, Bakthavatchaalam (2018) comments that there have not been any studies exploring the effect of indigenous factors on academics' RP in India. It is important to identify and analyse how cultural factors influence both the quantity and quality of the research.

Rather than exploring the influence of marital status, it would be better to look at the influence of the age group and the position in the HEIs that are correlated with the marital status. Though there is a trend towards its reduction in modern society, there still is a strong distinction of gender roles in the Indian environment.

Another interesting result was how the interaction between cultural factors and the department in which the academics worked influenced their research work. The respondents commented that female academics' preferences in terms of research areas do not include fields such as Mechanical, Civil engineering or research that involves a lot of travel or field work; rather, they choose to conduct research in humanities, computing or IT (Information Technology), which involve less travel and fieldwork. Though not explicit, female academics and their family do not feel comfortable travelling to a different city on their own. Hence, they choose to conduct research in fields that involve less field work as it is much safer. This again limits their RP, which is not an issue for the male academics. One of the male academics commented: "*Recently, a group of male colleagues travelled to various coastal fishing towns in south India for a few weeks to collect data on the efficient fuel usage by the fishing boats. They even went to the sea with the fishermen for observation. A female academic or a researcher would seldom do this. Even if they wanted to, their family will not allow them, as it is not safe*".

When asked if the institutions take any steps to mitigate or reduce such fears in female academics, the respondents commented that it is not about the institutions, but the current socio-cultural environment that is the problem. Whilst trying to formulate research policies, the institutions should consider these elements.

The interviews revealed how institutional Human Resource policies on maternity influenced female academics' RP. The respondents commented that, when they have a child and have to take time off for childbirth, female academics' academic positions are not put on hold, but that they have to resign from the post, and when they are ready to start working, they have to start job hunting all over again. The respondents commented that in public institutions there is much more job security during the maternity period, whereas in most of the private HEIs, which form more than 78% of the total HEIs in India (UGC-Report, 2017), the female academics' posts are not held secure and there is no job security when they return to work. This results in them taking a longer break before returning to work, thus limiting their RP, whereas this is not an issue for the male academics. Currently, there are no institutional policies that consider maternity in private HEIs and this paper also recommends that further research should be conducted to understand the reasons for such policies not in place and the type of maternity policies that should be put in place. Furthermore, the API scores could take into consideration such gender differences and give female academics more weightage that might make their RP more equitable.

Another factor that was mentioned by the interviewees was that the fact that female academics have a smaller research network compared to male academics hampering their RP. Having a smaller network or fewer contacts also means that female academics, when stuck in research or have some questions, are not sure of who and how to approach and find it difficult to get clarifications, whereas males find it relatively easy. This research suggests that providing career development, mentorship and encouraging female academics to attend more

conferences and research meetings would widen their formal and informal research network, which, in turn, would enhance their RP.

5. Concluding remarks

This research sought to quantitatively and qualitatively measure and understand RP of South Indian academics and to identify how gender differences influence RP. The quantitative results show no difference in RP based on gender, but the interviews revealed a plethora of factors, such as child-rearing, family life, the Indian societal culture, being able to access laboratories and physical resources off time, women getting married at a younger age compared to male academics, institutional maternity policies, etc., disadvantaging female academics compared to their male counterparts in terms of their RP.

It is essential that HEIs identify all the differences and develop policies accordingly so as to enable female academics to conduct research and increase their RP. Especially with more than 30% of the South Indian academics being female, it is important that more research is conducted to identify the differences and to design research policies that counteract the differences, thus providing equitable opportunities for female academics to conduct research and publish.

Along with the usually discussed factors in this sphere of research, this paper has managed to identify how cultural nuances play a major role in influencing RP between genders, thus adding to the discussion and opening up a new area for further research to be conducted It is encouraging that even though female academics face more issues than male academics, this research has identified no quantitative difference in genders' RP. The mechanisms by which female academics have the same RP as male academics at all the age groups, even though they face significant hurdles, should be explored in detail.

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