Chapter 7

Gender Differences in the Scientific Achievement of Social Sciences and Impact Factors: A Survey Study of Researchers in the Social Sciences in Vietnam

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Abstract

"The world needs science, science needs women" is the message given by UNESCO in the program for the development of women in science" (UNESCO, 2017). In Vietnam, women's participation and achievements in scientific research is considered a great and important resource for industrialization and modernization. Even so, are there gender differences in scientific achievement in the social science research institutes in Vietnam? What factors influence the scientific achievement of female social researchers? The answers will be based on data from a 2017 survey with a sample of 756 researchers, of which 77.6% were female. The survey was conducted by the Vietnam Academy of Social Sciences, a leading, ministry-level national center for the social sciences in Vietnam. This chapter analyzed the scientific achievements of researchers through their position as principal investigators of research projects and their publications, and factors that may impact this. Bivariate and multivariate analyses of factors that may affect the scientific achievement of researchers found that gender differences in academic achievement in the social sciences in Vietnam was still prevalent. Female researchers' scientific achievements were lower than those of their male counterparts. The contribution to science of Vietnamese female researchers was limited by many different factors; the most important were

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the academic rank of the researchers and gender stereotype that considered housework the responsibility of women.

Keywords: Vietnam; female researcher; gender equality; women's scientific achievement; gender stereotype; gender differences in social sciences

1. Introduction

Women's participation in scientific activities is important in providing unique perspectives; implementing international commitments on gender equality and science; and adding value to science in ways that benefit women, communities, the economy and the greater society (Hays and Farhar, 2000). However, in reality, the proportion of women working in science is not high. Data for 2017 from UNESCO (2020) showed that the proportion of women among scientists in different regions of the world was only about 30%. In the United States, women in 2017 accounted for 29% of social and engineering employment. Their presence varies across occupational categories. In 2017, women accounted for nearly half or more of the workforce in life sciences, psychology, and social sciences. In comparison, women accounted for 27% of computer and mathematical scientists, 16% of engineers, and 29% of physical scientists (National Science Broad, 2018). In addition, gender gaps in science productivity persisted in all disciplines and in most countries. For example, an analysis of scientists who published between 1900 and 2016 showed that, on average, male scientists published 13.2 articles during their careers, while female scientists published only 9.6. The difference was particularly evident for the top 20% of scientists with male scientists publishing 37% more than female scientists (Huang et al., 2020). Women in research institutions took longer to publish (West et al., 2013; Grogan, 2019), and their studies also received fewer citations in journals with higher impact factors (Ghiasi et al., 2015; Huang et al., 2020). Bird (2011) showed that across the social sciences in the UK, women published journal articles less than their male counterparts. This finding concurred with studies in the material and life sciences (Fox, 2005; Mauleon and Bordons, 2006). In Hong Kong, male professors tended to publish more books or articles than female professors. Men also received more research funding and presented their research at more scholarly conferences (Jung, 2012). Bird (2011) also reported that for those disciplines that had similar proportions of male and female academics and were traditionally considered to be more feminine (social policy and psychology), female's academic published articles were found at a level comparable with their representation. In contrast, the proportion of articles published by women was significantly lower than expected for the discipline of political science, traditionally deemed to be a masculine subject and with low levels of female academics (Bird, 2011).

In Vietnam, the government considers women participation in scientific research to be a great and important resource for the industrialization and modernization of the country. Therefore, there have been many policies to help all researchers in general and female researchers in particular, to promote their abilities through professional activities. For example, there is support for female

employees having children under 36 months old, when they participate in training. There are policies stipulating flexible forms of training suitable to the conditions and circumstances of female employees who are raising children and providing monetary support, accommodations, child care and preschool when female employees bring their children to the training and retraining institutions (Prime Minister's Decision No. 2395/2015/QD-TTg).

With the attention of the Government and the efforts of female scientists, more and more women are successful in scientific research. The total number of female scientific researchers has increased over the years. In 2011, the proportion of female researchers accounted for 41.6% of research staff. By 2015, this rate was 44.8% (MOST, 2016). In addition, the attainment of female researchers has also improved significantly, such as in the increasing percentage of female PhDs and professors (see Table 30). However, in comparison with male scientists, the percentage of female principal investigators (PI) for research project or authors of published scientific papers, especially for international publications, was still lower. Over the past years, the number of female scientists leading state-level scientific projects (the highest level in the system of projects funded by the government) was very small, usually about a quarter of the total (Nguyen Thi Viet Thanh, 2015). In some training institutions, the percentage of female officials in charge of projects at the ministerial and state levels was even lower (Nguyen Thi Tuyet, 2003; Huynh Truong Huy, 2014). The proportion of social sciences female researchers having publications in scientific journals was much lower than that

Table 30. Percentages of Female Scientists Who Received PhD Degree and Were Granted a Title of Associate Professor and Full Professor by Year.

Degree, Title	**2000**	**2007**	**2009**	**2013**	**2014**	**2015**	**2016**	**2017**	**2019**	**2020**
Ph.D.			21.4						28.0	
Associate Professor	7.0	11.7		22.57	23.59	26.38	30.0	29.8	25.2	23.7
Full Professor	4.3	5.1		5.26	5.08	9.62	9.0	9.4	12.1	15.3

Notes:
1. [PhD percentage] = [cumulative female PhD/cumulative total PhDs]*100.
2. [Associate professor percentages] = [Cumulative female associate professor/Cumulative total associate professors]*100. It was estimated for those who were granted title at a specific year of granting title.
3. [Full professor percentage] = [Cumulative female full professor/Cumulative total full professors]*100. It was estimated for those who were granted title at a specific year of granting title.

Sources:
1. Ph.D. figures: from the 2009 and 2019 Vietnam Population and Housing Censuses (GSO, 2010, 2020).
2. Professor figures: from Nguyen Thi Bao (2016) for data before 2016 and The State Council for Professorship (2020) for data from 2016 to 2020.

of male researchers (Nguyen Kim Hoa, 2010; Nguyen Tien Trung et al., 2019; Nguyen Thanh Thanh Huyen et al., 2020).

Thus, while more women were successful in scientific research, there were also many obstacles to their doing scientific research. As in the message "The world needs science, science needs women", given by UNESCO in the program "For the Development of Women in Science," held in Hanoi, November 2015, studying the achievements of women in scientific research is of urgent significance.

By using data from a study of social researchers in the Vietnam Academy of Social Sciences (VASS), the largest center of social sciences in Vietnam, this chapter aims to answer two research questions: (1) What are the gender differences in scientific achievement in the research institutes of social sciences in Vietnam? and (2) What factors affect the scientific achievements of female social researchers?

2. Background

Vietnam, located in Southeast Asia, shares land borders with China, Laos, and Cambodia. According to the 2019 Population and Housing Census, the country's population is more than 96 million (50.23% are women), ranking it third in total population in Southeast Asia and the 15th in the world (CSCCPH, 2019). Although a low-middle-income country with a per capita income of USD 2,779/person in 2020, Vietnam's Human Development Index was 0.704 in 2019, placing it 117 out of 189 other countries and territories (Nguyen Minh Phong and Nguyen Tran Minh Tri, 2021).

In Vietnam, there are two national, ministry-level, academic research institutions under the government: the VASS and the Vietnam Academy of Science and Technology. In addition, there are many research institutes belonging to other ministries. The Ministry of Science and Technology (MOST) has state management and is responsible for creating guidance and policies on science and technology for all research institutions. The Government of Vietnam always considers women's participation in scientific research a great and important resource for the industrialization and modernization of the country. In the last few decades, the Government has issued many policies to help female intellectuals develop their capabilities through professional activities as mentioned earlier. Thanks to that interest, more women are succeeding in scientific research (MOST, 2016).

Established in 1953, the VASS is now a leading national research institution for the social sciences in Vietnam with a total of about 1,905 employees, of which females were 55% in 2016 and more than 60% in 2019. VASS comprises of about 35 research institutes and centers located in three geographic regions of Vietnam (North, Central, and South). Over the past years, VASS has created better conditions and expanded opportunities for female staff members to develop their capacity to participate in research activities. The development of a contingent of scientific researchers is the focus and second goal of VASS' strategy "Building and developing a contingent of scientific staff of the VASS in terms of quantity and quality, building a team of highly qualified experts

and promising scientists capable of solving important scientific tasks, effectively participating in cooperation and international integration" (https://vass.gov.vn/Pages/Index.aspx).

With a policy of promoting initiative and creativity in scientific research, VASS leaders have created conditions for research institutes to proactively propose and implement ministry-level research projects. In staff training, for young staff under 35 years of age, VASS provides training activities to improve research methods, presentation skills, and project financial management skills. Opportunities for female researchers to develop their capacity in professional work, in management, and in improving their scientific status have been gradually expanded. Many female researchers who have achieved an excellent rating on their research projects and published in prestigious Institute for Scientific Information (ISI) and Scopus indexed international journals[1] have been nominated and awarded special professional titles. VASS leaders have also paid attention to female participation in managerial positions at all levels. For example, women account for 56.6% of department- level leaders (VASS, 2020).

Despite these gains, as noted by Tran Thi Van Anh (2011) and VASS (2008), until the first decade of the 21st century, the proportion of females as PI of academic projects and authors of scientific publications was still lower than that of males. There are many factors that have influenced scientific achievements and productivity, including academic rank, living standards, gender stereotypes, the burden of household chores, and the performance assessment of researchers by their superiors.

Academic ranks are important to the results of scientific research. Those with a doctorate degree generally focus more on research activities and achieve more scientific results and publications (Huynh Truong Huy et al., 2015; Jung, 2012). Rose et al. (2020) also confirmed a significant positive relationship between academic rank and research activity. For Vietnam, Nguyen Thi Kim Hoa (2010) and Tran Thi Van Anh (2011) indicated that the requirement of certain scientific degrees and ranks created obstacles for female researchers who did not have them to become a PI for ministry or higher-level project.[2]

Living standards and family duties also have significant influence on the achievement of scientific results. A low standard of living might make the researcher unable to wholeheartedly commit to scientific work. During their employment, women might be pregnant, give birth, and spend a considerable amount of time on housework, childcare, or parental care. In particular, these responsibilities are more difficult for young female researchers with young children than older and

[1]ISI journals: These journals have been ranked by the Institute for Scientific Information (ISI) and is currently maintained by Clarivate Analytics; Scopus journals: Scopus is the world's largest abstract and citation database of peer-reviewed research literature. It was introduced by Elsevier in 2004 (https://ieconferences.com/scopus-vs-isi-wos-which-one/: accessed 22/8/2021).

[2]For example, in many research institutions, only researchers who have PhD degree or Senior Researcher can do research as a PI of ministry or higherlevel projects.

more professionally experienced female researchers. As a result, many female researchers were overburdened and lacked time to rest, improve their knowledge, and stay up to date. Eventually, they were likely to be constrained by domestic realities, and their opportunities for advancement and promotion were reduced (Nguyen Thi Kim Hoa, 2010; Do Thi Thuy, 2012; Tran Thi Thanh Van, 2013; Kieu Quynh Anh, 2015; Besselaar and Sandström, 2016; Ho Huu Phuong Chi and Nguyen Tuan Kiet, 2020). Fox (2005) and Rose et al. (2020) confirmed significant negative relationship between time spending for housework and financial stress with academic productivity of female researchers.

Gender stereotypes were especially important in explaining the difference between women and men scientific achievement (Besselaar and Sandström, 2016). Some people thought that women did not have sufficient intellectual or academic qualities for working in research positions (Nguyen Kim Hoa, 2010; Franco-Orozco and Franco-Orozco, 2018). Many women were also less likely to be encouraged to pursue scientific research because women's main responsibility was seen as housework, and women were expected to support and prioritize men career progress over their own (Henley, 2015; Kieu Quynh Anh, 2015). Gilbreath (2015) emphasized that even now there were still traditional views and stigma surrounding women in the research workforce and men staying at home, because social norms dictated that men were the breadwinners and women were the caregivers.

Having institutional support and female-friendly workplaces have been found to significantly increase the success rates of female researchers (Kalev, 2009; Jung, 2012). Institutional support can refer to many things, including leaders fairly assessing researchers and paying attention to their work and life. Fair performance assessment of researchers by leaders was an important factor in promoting effort and enthusiasm among researchers (VASS, 2008; Nguyen Kim Hoa, 2010). Yip et al. (2020) identified good practices for promoting gender equality in scientific research, such as institutional policies that reduce the academic burden of women raising young children and caring for elderly parents. Studies have suggested that when mothers were given supportive structural opportunities, their productivity was at the same rate as childless women (Henley, 2015).

From the findings of previous literatures on the relationships between scientific achievement of researchers and contributing factors, some major hypotheses can be drawn:

1. There are still gender differences in the scientific achievement of social researchers; male researchers have more scientific contributions than female researchers.
2. Academic ranks have an important role in determining scientific contributions of researchers; those with higher ranks have higher scientific achievements.
3. Researchers who spend more time on housework have lower scientific achievements.
4. Researchers who have higher living standards have higher scientific achievements.
5. Researchers who are fairly assessed by leaders have higher scientific achievements.

3. Data and Analytical Methods

The data used in this chapter are from the ministry-level research project "Measures to promote roles of female researchers in the VASS," which was implemented in 2017 by VASS, with the first author as the principal investigator. Quantitative survey and qualitative interviews were conducted. In December 2016, prior to the survey, VASS had a total of about 1,300 researchers, not counting institute managers. Female researchers accounted for 56% or about 730 of the total. All available female researchers and one-third of male researchers in all 35 research institutes and centers were randomly chosen for comparative analysis. Because some researchers were not available during the time of survey and some cases were excluded due to missing information, the final dataset for analysis included 756 cases, of which 77.6% were females (587 cases).

Because the project was focused on the activities of female researchers, there were two separate surveys with different questionnaires for institute managers and researchers. All current institute managers and former managers within a year before the survey, who were still employed in the institute, were interviewed. Data for the institute managers are not used in this chapter.

The scientific achievement of women in social research is assessed through two dependent variables:

(1) *Previously was the Principal Investigator (PI)* in any ministry or higher-level project in the past five years, including ministry-level, national level, and National Foundation for Science and Technology Development (Nafosted) Fund (equivalent to the national level); Other ministry or higher-equivalent level: 1 = yes; 0 = no.
(2) *Total publications during the five years prior to the survey*: The total publications variable is the sum of articles and papers in domestic and international journals, book chapters, individual books, workshop proceedings reports, and policy consultancy reports. Each work is given a conversion publication rate based on the regulations of the State Council for Professorship with some modifications.[3] Specifically, articles in ISI and Scopus indexed journals are counted as two publications; articles in other international and domestic journals are counted as one publication. Domestic book chapters are counted as one publication. Book chapters on international publication are counted as 1.25 publications. Nationally published individual books are

[3]The State Council of Professorship regulations, as applied to the Committee of Philosophy, Sociology, and Political Sciences, state that articles published in prestigious ISI and Scopus journals or by the 500 prestigious universities in the world, score 1 to 3 points. If published in other international or national journals, they score 0 to 1 point. Reports for international workshops can receive 0 to 1 point and those for national workshops receive 0 to 0.5 point. Manuals, references, textbooks, monographs published in the country can receive 1 to 3 points. Books published by reputable publishers in the world receive an additional 25% of the book's conversion points. For the study, we assign the highest score to each work.

counted as three publications. Internationally published books are counted as 3.75 publications. International workshop proceeding papers are counted as one publication; national workshop proceeding papers are 0.5 publication. Policy consultancy report is counted as one publication. The total for this variable ranges from 0 to 72.5 publications.

To test the above hypotheses, we created the following independent variables:

1) *Sex*, with two values: 0 = Female researcher and 1 = Male researcher.
2) *Academic Rank*, with two values: 0 = Low Academic Rank and 1 = High Academic Rank. This variable was based on the researcher's academic degree and rank. At VASS, there are three levels of academic ranks, based on seniority and performance: Researcher, Senior Researcher, and High Senior Researcher. Researchers with PhD degree or have a Senior Researcher rank or higher are classified as High Academic Rank. All other researchers are classified as Low Academic Rank.
3) *Housework Time* per day, with two values: 0 = 4 hours or less and 1 = More than four hours. This variable was based on the mean and median of the number of hours spent on housework per day as reported in the survey questionnaire. The median hour is about four hours.
4) *Living Standards*, with three values: 1 = Difficult, 2 = Average, and 3 = Better-off. This variable was based on the researcher's self-assessment, in comparison to surrounding people. We did not have an income variable. Although housing condition could have been used for living standards, missing information on housing condition did not make this possible. With available information of housing condition we tested and found a very high correlation between the researcher's self-assessment of living standards with housing condition, so it was reasonable to base living standards on self-assessment.
5) *Performance Assessment from Leaders*, with three values: 1 = Totally fair; 2 = Mostly fair, and 3 = Not fair. This variable was based on the researchers' responses of the question "Do you agree that your leader fairly assess your ability and contribution in doing research?"
6) Applying gender and cultural approaches (Kabeer, 1994; Kwok and Bond, 2004), the paper examines the role of cultural factors in creating differences between men and women researchers. Based on the status-role view of Ralph Linton (quoted from Bilton et al., 1993; Le Ngoc Hung, 2009), the role of female researchers as the main person in housework is considered in the analysis and reflected in the above mentioned variable "Housework Time." In addition, using an interdisciplinary approach (Collins, 2000, 2015), a combination of factors that could influence the role of female researchers in scientific activities will be used, such as the interaction of the variable "Sex" and housework. It is hypothesized that effect of time spent on housework would be higher for females' academic achievement than males', because of social norms about women being responsible for housework. Thus, we created the interaction variable of sex*number of hours spent on housework with two values: 1 = Male, spending more than four hours and 0 = Others.

Some of main characteristics of interviewed researchers by sex are identified as below:

A comparison of the characteristics of male and female groups showed no significant differences between male and female researchers in terms of academic rank, living standards and performance assessment from leaders. However, there

Table 31. Main Characteristics of Interviewed Researchers by Sex (%).

Characteristics	**Female**	**Male**	**Total**
Total	587	169	756
%	77.6	22.4	
Dependent Variables			
PI in ministry or higher-level projects during the last five years			
Total (*N*)	587	169	756
Ever (%)	14.0	17.2	14.7
Never (%)	86.0	82.8	85.3
Mean number of Scientific Publications*			
Total (*N*)	570	166	736
Mean	6.3	8.3	6.8
Independent Variables			
Total (*N*)	587	169	756
Academic Rank			
Low	72.9	73.4	73.0
High	27.1	26.6	27.0
Number of Housework Hours per Day***			
Four hours or less	47.4	74.0	53.3
More than four hours	52.6	26.0	46.7
Living standards*			
Difficult	23.7	33.1	25.8
Average	67.0	62.1	65.9
Better-0ff	9.3	4.8	8.3
Performance assessment from leaders			
Totally fair	27.8	34.3	29.2
Mostly fair	51.8	47.9	50.9
Not fair	20.4	17.8	19.8

Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

is a large gap for the time spent on housework by males and female researchers, which can affect their academic achievements.

The analysis was first done by comparing the scientific achievement between men and women to see the overall gender differences. Next, following a bivariate analysis (using chi-square, *T*-test or ANOVA test), theoretically important factors will be included in the multivariate model analysis, using logistic regression or multiple classification analysis (MCA) regression. MCA is a form of regression analysis that is widely used with categorical independent variables (Andrews et al., 1973). Multivariate analyses will be used to analyze the total sample of male and female researchers and just female researchers.

Procedures to test interaction effects of housework time associated with female or male researchers are provided in Appendix 1.

4. Analysis Results

4.1. Gender Differences in Scientific Achievement

Principal Investigator (PI) in Ministry or Higher-level Projects. The percentage of researchers who were PIs in ministry or higher-level research projects, within five years of the survey, is shown in Fig. 14. In general, there was a gender difference between male and female researchers in serving as PIs: male researchers had a higher percentage of being PIs in ministry or higher-level projects (17.2% vs. 14.0%). This difference, however, is negligible.

Publications. Male researchers had a significantly higher mean number of scientific publications than female researchers (8.3 vs. 6.3). The difference is present for both national and international publications. Significant difference, however, was clearly found only for national publications (Fig. 15).

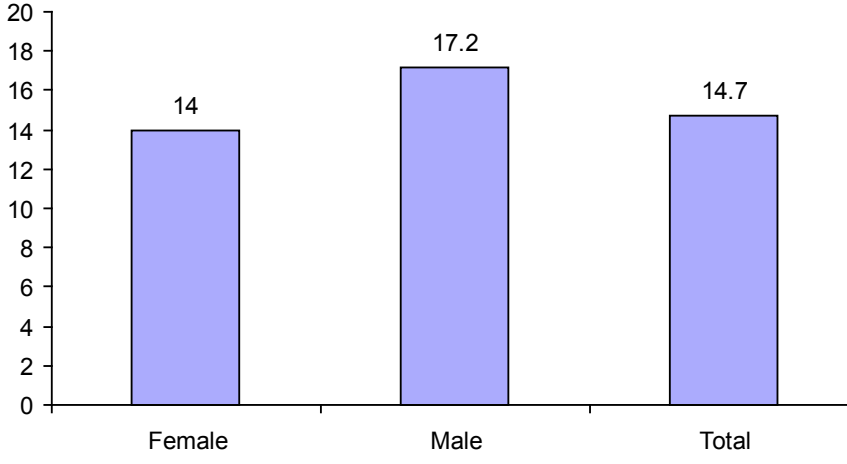

Fig. 14. Percentage of Principal Investigators in Ministry or Higher-level Research Projects by Sex.

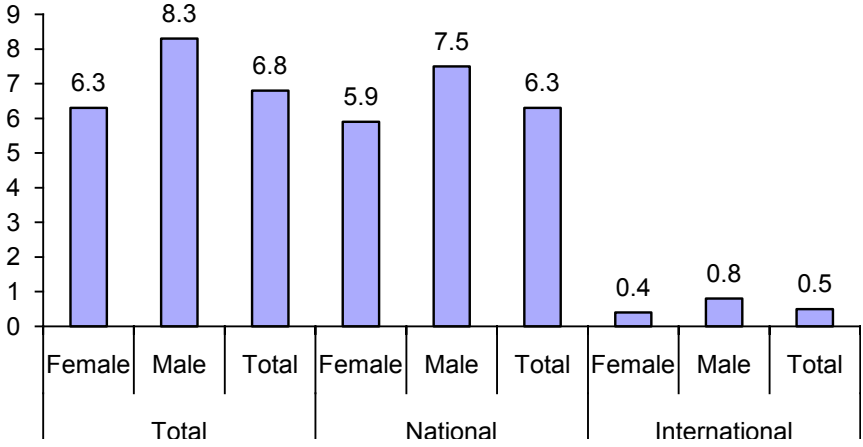

Fig. 15. Mean Number of Scientific Publications by Sex.

4.2. Factors Influencing the Scientific Achievement of Researchers

As pointed out above, socio-demographic characteristics of female or male groups can make a difference in research productivity between them. For example, male researchers usually spend less time on housework than female researchers, which would increase their time for doing research and contributing more scientific products than female researchers. Moreover, a higher proportion of male researchers have difficult living standards compared to female researchers, and the financial stress hampered males in focusing on doing research. Therefore, it is necessary to compare these two dependent variables according to the specific characteristics of female or male researchers.

Factors Influencing Being Principal Investigators in Ministry or Higher-Level Research Projects

Table 32 presents the percentage of researchers who were PIs in ministry or higher-level research projects related to the researchers' characteristics. Chi-square tests were applied for cross tabulations. For both male and female researchers, those with a high academic rank had a higher percentage of being a project PI. Researchers who spent more than four hours on housework had a lower percentage of being a project PI than those spending four hours or less. There was, however, a larger difference for female researchers than male researchers.

The standard of living factor seemed to have important positive implications for researchers of both sexes working as project PIs, while the performance assessment by leaders of the researchers was not important for both male and female groups. Those with better living standards tended to have a higher percentage of being project PIs.

In order to have a more accurate assessment of the role of gender for participation as project PIs, when all factors are controlled, a logistic multivariate

Table 32. Percentage of Principal Investigators in Ministry or Higher-level Projects by Respondent Characteristics.

Characteristics of Scientists	Female		Male		Total	
	%	N	%	N	%	N
Total	14.0	587	17.2	169	14.7	756
Academic rank	***		***		***	
Low	2.8	428	5.6	124	3.4	552
High	44.0	159	48.9	45	45.1	204
Housework time per day	***				**	
Four hours or less	19.4	278	15.2	125	18.1	403
More than four hours	9.1	309	22.7	44	10.8	353
Living standards	***		**		***	
Difficult	4.3	139	5.4	56	4.6	195
Average	15.0	393	23.0	113	16.5	498
Better-0ff	30.9	55			31.7	63
Performance assessment from leaders						
Totally fair	13.5	163	13.8	58	13.6	221
Mostly fair	15.1	304	19.8	81	16.1	385
Not fair	11.7	120	16.7	30	12.7	150

Significance level: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Note: We regrouped the variable "Living standard" of male into two groups (because the group Better-off is too small, with only eight cases).

regression was performed with the dependent variable being a PI in ministry or higher-level research projects during the last five years: 1 = Ever; 0 = Never. The independent variables included sex, academic rank, housework time, living standards, and performance assessment by leaders.

As mentioned earlier in the data analysis section, because the effect of time spent on housework may be different for females and males, an interaction variable of sex and housework time is included in the model. To test the interaction variable, we first run a logistic regression for sex and housework time as an additive model. Next, we run a logistic regression for sex, housework time and the interaction variable. It was shown that the interaction variable had a significance level of $p < 0.05$ (exact $p = 0.006$), so this interaction variable needed to be in the multiple model (see Appendix 2).

The analytical results for the entire sample and the female scientist sample are presented in Table 33.

The analytical results in Table 33 show that, for the entire sample of female and male researchers, the factors that had a significant impact on a researcher's

Table 33. Factors Having an Impact on Being Principal Investigators in Ministry or Higher-level Research Projects (Logistic Regression Results).

Independent Variables	**Total Sample**		**Female Sample**	
	OR	*N*	**OR**	*N*
Sex				
Female	0.8	587		
Male	1	169		
Academic rank				
Low professional	0.1***	552	0.1***	428
High professional	1	204	1	159
Housework time per day				
Four hours or less	2.1**	403	2.1**	278
More than four hours	1	353	1	309
Living standards				
Difficult	0.2**	195	0.2*	139
Average	0.5	498	0.6	393
Better-0ff	1	63	1	55
Performance assessment from leaders				
Totally fair	0.7	221	0.8	163
Mostly fair	1.2	385	1.2	304
Not fair	1	150	1	120
Interaction of sex and number of housework hours				
Others	0.4	712		
Male, more than four hours	1	44		
Nagelkerke *R* Square	0.43		0.44	
N		756		587

Significance level: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

ability to work as PIs in ministry or higher-level projects were academic rank, housework time, and living standards. Those with a high academic rank, spent less time on housework, and had a higher standard of living were more likely to become PIs. Thus, *H2, H3*, and *H4* about the important roles of academic ranks, housework time, and living standards on scientific achievements were confirmed, while *H5* about the impact of performance assessment by leaders was not confirmed. This result reflects the fact that the process of selecting a project manager at the ministry or higher level was mainly based on high academic rank, but other family factors might affect that result.

As to gender, there was no gender difference in becoming project PI for researchers who spent 4 hours or less on housework. In other words, if researchers did not spend much time on housework, their gender would not make any difference in being project PI. On the other hand, female researchers who spent four hours or less on housework were two times more likely to be project PI than those spending more than four hours on housework. In other words, housework time had more of an effect on female researchers. This reflects the role of female researchers as caregivers in the family. Thus, *H1* about gender differences in the scientific achievement of social researchers was partially confirmed.

A separate analysis of the female sample showed similar results. Female researchers who had high academic rank, better-off living standards, and spent less time on housework were more likely to be project PIs than their counterparts.

Factors Influencing the Total Number of Scientific Publications

Analysis of scientific publication by researcher's characteristics is presented in Table 34 for the overall sample and separate female and male samples. In this analysis, due to some missing information of scientific publication, only 736 cases for both sexes were analyzed. A *T*-test was used for independent variables with two categories and the ANOVA test was applied to variables with three categories.

The general picture showed that male researchers had a significantly higher mean number of scientific publications than female researchers. High academic rank was closely related to the number of publications. Researchers with high academic rank had about 2.7 times as many publications as those with low rank. Housework time was also associated closely with number of scientific publications; those who spent less time on housework had more publications than those spending more time. The effect of housework time, however, seems strong only for female researchers. Female researchers spending more than four hours on housework were less likely to publish than those spending four hours or less, while there was no significant difference between the two groups of male researchers.

Similar to the association of publications and housework time, the living standards factor was closely related to the number of scientific publications by female researchers but not for male researchers. This finding suggest a stronger effect of family responsibilities on female researchers whose housework burden was often heavier than that of men. In contrast, for both sexes, the performance assessment by leaders was not closely related to the number of their publications.

To accurately assess the individual impact of each independent variable, MCA regression procedure was performed, with the number of publications as the dependent variable and with the independent variables discussed earlier. The analyses were for both sexes and separately for females. The results are presented in Table 35.

Interaction variable of sex*housework time was tested, and the results are presented in Appendix 3. Results showed that when added, the interaction variable sex*housework time was significant at $p = 0.009$. Therefore, this interaction variable should be included in the multiple regression models.

Table 34. Mean Number of Scientific Publications by Respondent Characteristics.

Independent Variables	Female		Male		Total	
	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)	*N*
Total*	6.3 (7.1)	570	8.3 (9.7)	166	6.8 (7.8)	736
Academic rank	***		***		***	
Low	4.3 (4.4)	413	5.8 (6.8)	123	4.6 (5.1)	536
High	11.8 (9.5)	157	15.5 (13.0)	43	12.6 (10.4)	200
Housework time per day	***				**	
Four hours or less	7.5 (8.1)	264	7.9 (8.5)	122	7.6 (8.2)	386
More than four hours	5.4 (5.9)	306	9.0 (10.6)	44	5.9 (7.2)	350
Living standards	**				*	
Difficult	4.6 (5.0)	134	7.6 (7.8)	56	5.5 (6.1)	190
Average	6.8 (7.6)	383	8.7 (10.6)	110	7.2 (8.4)	485
Better-0ff	7.6 (6.9)	53			7.3 (6.9)	61
Performance assessment from leaders						
Totally fair	6.1 (5.7)	159	10.6 (14.3)	55	7.3 (8.9)	214
Mostly fair	6.6 (6.7)	298	7.3 (5.4)	81	6.8 (6.5)	379
Not fair	6.0 (9.3)	113	7.0 (8.2)	30	6.2 (9.1)	143

Note: For males, the variable "Living standards" was regrouped into two groups (because the group Better-off is too small, with only 8 cases).Significant level: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 35. Factors Having an Impact on the Number of Scientific Publications (MCA Analysis).

Independent Variables	Total Sample = 736 Grand Mean = 6.8			Female Sample = 570 Grand Mean = 6.3		
	Unadjusted Deviation	Adjusted	*N*	Unadjusted	Adjusted	*N*
Sex						
Female	−0.5	−0.3	570			
Male	1.5	1.0	166			
Eta/Beta	0.11	0.07				
Academic rank						
Low	−2.2	−2.1	536	−2.1	−2.0	413
High	5.8	5.7	200	5.4	5.2	157
Eta/Beta	0.46	0.45***		0.48	0.46***	
Housework time per day						
Four hours or less	0.8	0.7	386	1.1	0.8	264
More than four hours	−0.9	−0.7	350	−1.0	−0.7	306
Eta/Beta	0.11	0.09*		0.15	0.10**	

Living standards						
Difficult	−1.3	−0.4	190	−1.8	−0.7	134
Average	0.5	0.3	485	0.4	0.3	383
Better-off	0.5	−0.8	61	1.3	−0.2	53
Eta/Beta	0.1	0.05		0.14	0.06	
Performance assessment from leaders						
Totally fair	0.5	0.2	214	−0.2	−0.5	159
Mostly fair	−0.1	0.1	379	0.3	0.3	298
Not fair	−0.6	−0.4	143	−0.4	−0.1	113
Eta/Beta	0.05	0.03		0.04	0.05	
Interaction of sex and housework time						
Others	−0.2	−0.1				
Male, More than 4 hours	2.9	1.8				
R square	0.23			0.24		
N			736			570

Significance level: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

The results showed that, after all variables were controlled for, the gender factor did not have a significant effect on scientific publications. No significant difference in the number of publications was found between male and female researchers, among those who spent four hours or less on housework. This means that the *H1* about the impact of gender factor was not confirmed. For female researchers, however, those who spent four hours or less on housework had 1.4 more publications than those who spent more than four hours on housework. These results confirm the *H3* on the association between housework time and scientific achievement of researchers.

The analysis showed that academic rank was a very important factor: the higher the academic rank, the higher the number of publications, as hypothesized. Regarding the effect of living standards, after controlling for all variables, there were no significant differences in publications among the three groups of living standards. Like the bivariate analysis results, performance assessment by leaders did not make a significant difference in the number of scientific publications. Thus, the *H4* and *H5* about the roles of living standards and performance assessment by leaders were not confirmed for publications.

The impact of these factors on the scientific publications of both sexes was also evident in comparing groups of female researchers. The number of publications was significantly influenced by the researcher's academic rank and time spent on housework.

5. Discussion and Conclusion

Data analyses from one study in the largest center for the social sciences in Vietnam showed that, although the number of female researchers had increased in recent years, their scientific contributions were still limited compared to male researchers. In other words, there were still gender differences in the scientific achievement of researchers, as shown by the lower proportion of females as project PIs and the lower number of publications. Thus, the *H1* about gender differences in the scientific achievement of social researchers was confirmed by this study. These observations show that simply increasing the number of women doing scientific research is not enough to achieve gender equality.

The contribution to science of Vietnamese female researchers was influenced by many different factors. The most important factor was the academic rank of the researchers, and the second, was the time spent on housework. The researcher's academic rank was measured mainly by academic degree and professional rank within VASS. Academic ranks, however, were closely tied to time spent on housework. Researchers who spent more time on housework had less time to spend on doing research and learning, in order to improve their ranks (Tran Thi Van Anh, 2011; Nguyen Thi Bao, 2016; Ho Huu Phuong Chi and Nguyen Tuan Kiet, 2020). The above research results also showed that, in the group with little housework, the difference between women and men in scientific achievement was not significant. Within the female group, however, there was a huge difference in achievement between those who did more and less housework. Thus, the current gender differences in scientific contributions were mainly caused by gender

stereotypes, with the notion that women had the main housework duty and men were to pursue their career.

Gender norms in Vietnam, as well as in many countries around the world, attach domestic work to the women, including female researchers (Tran Thi Van Anh, 2011; Gilbreath, 2015; UNESCO, 2017, etc.). Therefore, female researchers will give priority to their husbands to work outside the home, while they bear the burden of housework. Thus, female researchers perform dual roles, of professional scientist and domestic family caregiver. This is an important cultural barrier that limits the quality of the research results and affects the achievements of female social scientists. Among the 290 respondents who gave the reasons for not taking advantage of the opportunity to participate in long-term training (both domestic and oversea), the highest percentage (60.3%) was due to unfavorable family work. This rate for women was 63.7% and for men 46.4%. Many female researchers as well as research institute leaders also emphasized the disadvantages faced by women who have to spend too much time on household duties, from raising children to taking care of elderly family members. They considered family chores as the main reason why female researchers were still limited in their contribution, as compared to men.

These results are similar to previous findings in other countries (Besselaar and Sandström, 2016; Franco-Orozco and Franco-Orozco, 2018) and in Vietnam (Nguyen Thi Kim Hoa, 2010; Phan Thuan and Tran Kim Lien, 2015; Ho Huu Phuong Chi and Nguyen Tuan Kiet, 2020), which emphasized that gender stereotypes lead some women to not really try to create good scientific publications. Findings from this study also provide empirical evidence for the social identity theory that emphasized the importance of social categories, such as gender, to explain the distinction of self and others (Randel, 2002). Thus, *H2* and *H3* about the impacts of academic ranks and housework time on scientific achievement were confirmed in this study. At the same time, this study also showed results different than those of Vuong et al. (2017), who analyzed data from the Scopus dataset and argued that in the field of social sciences in Vietnam, women's marital and parental responsibilities no longer appear to hinder their scientific productivity. This difference may be due to the different ways the number of publications was calculated and that our study did not take into account the co-authors, which suggests further analysis.

The hypothesis about the important role of living standards in scientific achievement for researchers had been partially confirmed. A higher standard of living created more conditions for researchers to participate as project PIs. This factor, however, did not significantly affect the number of published works. This means that the role of living standards vary depending on how scientific achievements are measured.

The results did not clearly show the important role of work environment factor in gender differences in scientific achievement, using performance assessment by leaders, as stated in the last hypothesis. As stated elsewhere (VASS, 2008; Nguyen Kim Hoa, 2010; Yip et al., 2020), a fair and accurate assessment by leaders will motivate researchers to become more passionate and active in research, thereby contributing more to science. Results from

this study, however, showed that the assessment of the institute's leaders did not make a significant difference in the scientific outputs of female and male researchers. It is possible that more relevant indicators are needed to explain this issue, such as support by leaders for female researchers to balance family responsibilities through flexible time work and developing appropriate training for female researchers.

In summary, gender differences in social science achievement in Vietnam is still a fact, and a very important factor is gender stereotypes that regard housework as a woman's responsibility. This has limited female researchers' contribution in science and thus will hinder their contribution to the country's industrialization and modernization.

Respecting and promoting the development of women's intellectual resources is an inevitable solution suitable for social development. Therefore, organizations and leaders need to implement gender-responsible solutions to create conditions for female social scientists to overcome the difficulties of household duties to participate in training and doing research better. Gender characteristics should be paid attention to in organizing training classes to have the most suitable form of training courses for female researchers. It is also important to avoid the extreme view that as women are busy with housework, less should be required of them than men. Such gender stereotypes will continue to inhibit the professional efforts of female staff and limit their contributions. Specific solutions for training, retraining, and research management of female researchers, from a gender perspective, will help to continuously improve their research capacity. In turn, they will make better scientific contributions in the social sciences in Vietnam.

Limitation of the Study

First, as mentioned earlier, data for this study was drawn from the project that focused on female researchers so there was an unbalanced percentage of females and males in the sample, which can create potential biases for analyzing the total sample. To avoid this, we included control variables. In addition, with almost 170 male respondents, we believe the male sample is sufficient in size to compare male and female researchers.

Second, living standards was based on respondent self-assessment and may not capture the exact economic situation of the respondents. We, however, did test the correlation of this variable with the housing condition variable and found a high correlation. Thus, we can use the self-assessed living standards variable for the analysis.

Third, even though the managers of institute and centers within VASS are also researchers, they were not included in the analysis because information from them was on a separate questionnaire. Moreover, some characteristics for use as independent variables were not available, such as the number of hours spent on housework, living standards, performance assessment from leaders. Therefore, the manager information was not analyzed.

These limitations should be considered for the next study of this issue.

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Appendix 1. Procedures to Test Interaction Effects

For linear regression I apply the following procedures which are described in detail in Phananiramai (1981):

(1) If the interaction term is not significant at $p < 0.05$, the interaction term is deleted.
(2) If the interaction term is significant at $p < 0.05$, the ratio of the sum of squares associated with the interaction term to the sum of squares associated with the main effect is calculated. If the ratio is less than 0.05, the interaction is also deleted.
(3) The contribution of the interaction term to the *R*-square is assessed. If it increases *R*-square by more than 1 percent, this interaction term is considered to be "important."

For logistic regression the test is based upon the following three criteria:

(1) If the interaction term is not significant level at $p < 0.05$, the interaction term is deleted.
(2) If the interaction is significant at $p < 0.05$ then the increment of Model chi-square between the additive models which includes two predictors, and the models with adding interaction terms is estimated. If the increase of chi-square is not statistically significant at significance level of 0.05, the interaction is deleted.
(3) The magnitude of change in R_L square. R_L square "is a *proportional reduction in the absolute value of the log-likelihood* measure. It indicates by how much the inclusion of the independent variables in the model reduces the badness-of-fit D_0 chi-square statistic" (Menard, 1995, p. 22) If the magnitude of the change in R_L square is large enough (I am not sure how large is enough, however, in his example, Menard (1995, p. 54) considers the increase of 0.016 small), then we can determine that the interaction is statistically and substantively significant.

R_L square is estimated as follows:

$$R_L \text{ square} = G_M/D_0$$

where G_M is "Model Chi-square Improvement" in SPSS output and D_0 is "Initial Log Likelihood Function −2 Log Likelihood" in SPSS output.

Appendix 2. Results of Testing Interaction Effects for Logistic Regression

1) Without interaction: Independent variables include Sex and Housework Time

Model Summary.

Step	−2 Log Likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	622.326[a]	0.011	0.020

-.[a] Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001.

Variables in the Equation.

		B	SE	Wald	df	Sig.	Exp(*B*)
Step 1[a]	Sex(1)	−0.097	0.243	0.159	1	0.690	0.908
	Housework Time(1)	0.588	0.220	7.153	1	0.007	1.801
	Constant	−2.031	0.272	55.927	1	0.000	0.131

[a]Variable(s) entered on step 1: sex, housework time.

*2) With Interaction: Independent variables include Sex, Housework Time, and Sex*Housework Time*

Model Summary.

Step	−2 Log Likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	615.281[a]	0.020	0.036

[a]Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001.

Variables in the Equation.

		B	SE	Wald	df	Sig.	Exp(*B*)
Step 1[a]	Sex (1)	0.296	0.292	1.033	1	0.310	1.345
	Housework time (1)	0.883	0.250	12.538	1	0.000	2.419
	Sex*Housework time (1)	−1.379	0.504	7.492	1	0.006	0.252
	Constant	−1.224	0.360	11.573	1	0.001	0.294

[a] Variable(s) entered on step 1: Sex, Housework Time, Sex*Housework Time.

Appendix 3. Results of Testing Interaction Effects for Linear Regression

1) Without interaction: Independent variables include Sex and Housework Time

ANOVA[a].

Model			Sum of Squares	df	Mean Square	*F*	Sig.	*R* Square Change
1	Subset tests	Sex, housework time	836.300	2	418.150	7.015	0.001[b]	0.019
	Regression		836.300	2	418.150	7.015	0.001[c]	
	Residual		43,692.433	733	59.608			
	Total		44,528.732	735				

[a] Dependent variable: number of converted publication over five years.
[b] Tested against the full model.
[c] Predictors in the full model: (constant), sex, housework time.

Coefficients[a].

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	7.068	0.451		15.677	0.000
	Sex	1.631	0.699	0.088	2.333	0.020
	Housework time	−1.359	0.585	−0.087	−2.323	0.020

[a] Dependent Variable: number of converted publication over five years.

*2) With Interaction: Independent variables include Sex, Housework Time, and Sex*Housework Time*

ANOVA[a]

Model			Sum of Squares	df	Mean Square	*F*	Sig.	*R* Square Change
1	Subset tests	Sex, housework time, sex* housework time	1,241.597	3	413.866	6.999	0.000[a]	0.028
	Regression		1,241.597	3	413.866	6.999	0.000[b]	
	Residual		43,287.136	732	59.135			
	Total		44,528.732	735				

[a] Dependent Variable: Number of converted publication over five years.
[b] Tested against the full model.
[c] Predictors in the Full Model: (Constant), Sex, Housework Time, Sex* Housework Time.

Coefficients[a].

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
		B	SE	Beta		
1	(Constant)	7.459	0.473		15.761	0.000
	Sex	0.393	0.842	0.021	0.467	0.641
	Housework time	−2.088	0.646	−0.134	−3.233	0.001
	Sex*Housework time	3.923	1.499	0.120	2.618	0.009

[a] Dependent Variable: Number of converted publication over five years.