

Vietnam, Women, and Science: Mental Barriers and Gender Gap

Vietnam, mujeres y ciencia: barreras mentales y brecha de género

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Daniel Lemus-Delgado¹

Abstract

Considering the cultural context of Vietnamese society, this article explores the influence of mental barriers regarding the traditional role of women and its impact on their possibilities to participate in scientific activities. Vietnam is a country that has promoted scientific and technological activities and the strengthening of a national innovation system as a critical element on its path to development. These actions have made it possible to shore up economic growth that began with opening up and economic reform. In this way, Vietnam has achieved some critical achievements in the economic and social fields. However, reducing the gender gap in scientific activities is still a vital challenge, although the government has taken significant measures to overcome it. The article analyzes the relationship between women in science in Vietnam and the gender stereotype based on data collected through reports of international organizations, news reports, and other relevant data. The principal argument is that this situation results from the mental barriers of Vietnamese society that present strong stereotypes regarding the role of women. Therefore, to advance gender equality, changing the mental stereotypes still present in Vietnamese culture is necessary.

Resumen

En este artículo se explora la influencia de las barreras mentales respecto al papel tradicional de las mujeres y su impacto en sus posibilidades de participar en actividades científicas, considerando el contexto cultural de la sociedad vietnamita. Vietnam es un país que ha impulsado las actividades científicas y tecnológicas y el fortalecimiento de un sistema nacional de innovación como elemento crítico en su camino hacia el desarrollo. Estas acciones han permitido apuntalar el crecimiento económico que comenzó con el proceso de reforma y apertura económica. De esta manera, Vietnam ha obtenido algunos logros significativos en los aspectos económicos y sociales. Sin embargo, reducir la brecha de género en las actividades científicas sigue siendo un desafío vital, aunque el Gobierno ha tomado medidas importantes para superarlo. En el artículo se analiza la relación entre las mujeres en la ciencia en Vietnam y el estereotipo de género a partir de datos recopilados a través de informes de organizaciones internacionales, reportajes noticiosos y otros documentos relevantes. El argumento principal es que la brecha de género en las actividades científicas es resultado de las barreras mentales de la sociedad vietnamita, que presentan fuertes estereotipos sobre el papel de la mujer. Por lo tanto, para avanzar en la igualdad de género es necesario cambiar los estereotipos mentales aún presentes en la cultura vietnamita.

Keywords: women, science, gender stereotypes, Vietnam, Confucianism.

Palabras clave: mujeres, ciencia, estereotipos de género, Vietnam, confucianismo.

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1. Tecnológico de Monterrey. Av. Gral. Ramón Corona, núm. 2514. Colonia Nuevo México. C. P. 45201. Zapopan, Jalisco, México. ORCID: <https://orcid.org/0000-0003-1002-5319> Correo electrónico: dlemus@tec.mx. La elaboración de este artículo fue posible gracias al fondo "Advancing towards Gender Equality in Higher Education: Best Practices to Promote Equity in Scientific Research" del Tecnológico de Monterrey.



1. Introduction

In the 21st century, Vietnam has been one of the countries that has experienced the highest economic growth. Vietnam has changed from primarily agricultural to an industrialized and urbanized country with huge social impacts. Even more significant, the Vietnamese economic transformation expressed in vibrant and flourishing urban development is evidence that the terrible years of the Vietnam War, which caused at least 1.1 million militaries and almost 2 million civilian deaths from 1954-75 and the destruction of virtually every industrial establishment, numerous towns and cities, thousands of villages, all the bridges, most of the dams and hundreds of schools, colleges, and hospitals in North Vietnam, have been left behind (Lien & Sharrock, 2014).

Vietnam adopted several reforms to transition from a Soviet-inspired centralized planned economy to an open and internationally connected economy (ten Brink, 2019; Kien & Heo, 2008). The culminating point of this process occurred in 2007 when Vietnam joined the World Trade Organization (Cao, 2013). In addition, the commercial war between the United States and China, which began during the administration of President Trump, has promoted a process of relocation of companies that are improving the economic prospects of Vietnam for the coming years (Ha & Phuc, 2019).

Although the Communist Party of Vietnam (CPV) has achieved the desired independence and national reunification, in the decade of 1980 Vietnam was among the world's poorest countries. In 1986, the CPV launched a reform program known as *Đổi mới* that became the origin of economic transformation (London, 2023). After *Đổi mới* reforms, Vietnam has grown faster than most other countries in the East and Southeast Asia region, except China (Lemus-Delgado, 2020). Between 1990 and 2019, real GDP growth was strong, averaging 6.8% in the 1980s to nearly 10% in 2020; at the same time, during the financial crisis of 1997 and 2008, other Southeast Asian countries experienced severe recessions; however, Vietnam maintained constant growth (OECD, 2023). Despite the unfavorable environment of the world economy experienced by the Covid-19 pandemic, Vietnam adequately resisted the economic challenges derived from these world crises. Economic activities recovered quickly, and the economy grew by 8% in 2022, the highest growth since 2011, driven by domestic consumption recovery, resilient exports, and solid expenditure of foreign direct investment (International Monetary Fund, 2022).

The result of these reforms has been spectacular. At the beginning of the year 2000, Vietnam's Gross National Income (GNI) in Purchasing Power Parity (PPP) per capita was 199.39 (billions USD); by the year 2021, this figure had increased 1,079.77 while the GNI per capita PPP went from 2,520 USD to 11,080 USD in the same period (World Bank, 2023). The unemployment rate went from 12.3% in 1990 to 2.4% in 2022 (World Bank, 2023). Finally, in the year 2021, the proportion of the Population Living below the National Poverty Line only was 4.4% (Asian Development Bank, 2023), and Vietnam ranked 115th on the Human Development Index in the year 2022 (UNDP, 2022). However, these economic benefits have impacted men and women differently, and the gender gap is a significant challenge. Although the life expectancy at birth for females is 78.2 years while for males is 69.1, the Gross National Income per capita was in the year 2021 6,932 PPP USD for women and 8,826 PPP USD for men (UNDP, 2023). Also, the gender wage gap persists in Vietnam even though women have achieved similar levels of education as men or even surpassed men at higher levels of education (Chowdhury et al., 2019).

A way to advance on the development path has been to strengthen the innovation, science, and technology system. The generation, diffusion, absorption, and application of new technology, knowledge, or ideas are crucial development drivers (Brahmbhatt & Hu, 2007). The experience of other successful economies in East Asia suggests that it is necessary to consolidate a public policy that underpins innovation, science, and technology activities. For middle-income countries like Vietnam, innovation demands the invention of new products and processes at the Industry 4.0 edge and the diffusion and adoption of existing technologies or practices (Cirera et al., 2021). The historical experience of Japan, South Korea, Taiwan, Singapore (Vogel, 1993), and more recently, China (Fu, 2015), shows that the consolidation of a solid and robust innovation system and the strengthening of scientific and technological activities, supported by a medium- and long-term vision, is an essential path to advance in this development path to transit from a model of industrialization based on how the goods in workshop have moved from being 'assembled in' through 'invented' in to 'invented and commercialized' in prosperous country.

Nevertheless, programs that promote innovation, science, and technology will only be successful if they generate new economic structures that allow high and lasting economic growth. This effort is useless if it ignores the possibility of developing the structural conditions that will enable the gender gap

that exists in scientific activities to be reduced. As Hays and Farhar (2000) noted, women's participation in scientific activities is vital in providing unique perspectives, implementing international commitments on gender equality and science, and adding value to science to benefit women, communities, economy, and society. The central question is whether Vietnam can replicate the story of economic success and development by incorporating women into scientific activities. The participation of women in science research has grown during the last decades. However, they still face various challenges, such as the "glass ceiling," social stereotypes, low recognition, and underrepresentation (Vuong et al., 2021). The successful incorporation of Vietnamese women in science activities is not only of economic benefit but social justice. Despite, an interpretation of the Confucianism legacy is not the only reason that limits the advancement of gender equity in scientific activities; the article suggests that this mental framework is a critical factor.

In order to understand the relationship between the Vietnamese National Innovation System and the mental barriers that impact the gender gap in scientific activities, this article has three sections. The first section analyzes the National Innovation System and the gender gap in Vietnam, evidencing the inequities present for women that limit their possibilities to dedicate themselves professionally to scientific activities. Later, this study explores the barriers to advancing gender equality, empathizing with how the mental obstacles based on the traditional role of women in Vietnamese society limit women's participation in scientific activities. Finally, the conclusions highlight that the most crucial challenge to incorporating women into the Vietnamese National Innovation System entirely is to break down the mental barriers that perpetuate stereotypes about the role of women and their capabilities. The methodology framework of the article is qualitative research using secondary data. This methodology is a crucial tool for exploring the relationship between mental barriers and the gender gap by leveraging existing data sources and building upon existing knowledge (Cheong et al., 2023).

2. The National Innovation System and Gender Gap

In recent years, Vietnam has gradually improved its position in international indices that measure international competitiveness. In the Global Innovation Index, Vietnam ranked 70th in 2008; by 2021, Vietnam improved its global position and ranked 48th (World Intellectual Property Organization, 2022).

However, Vietnam's best global position today is not due to strengthening the scientific and technological sector or university education, two critical pieces in any national innovation system. In the research and development (R&D) pillar, Vietnam ranked 68th. In contrast, tertiary education ranked 90th out of 132 economies analyzed (World Intellectual Property Organization, 2022).

According to Innovation Global, in 2022, Vietnam occupied an intermediate performance position (table 1). According to this analysis, the pillars of innovation that are Vietnam's strengths are market sophistication and creativity. This index coincides with the recommendations of the World Economic Forum that warn that Vietnam needs to advance more in the formation of specialized human capital and its research activities.

Table 1
Vietnam Performance According to the Global Innovation Index

<i>Rank</i>	48
<i>Institutions</i>	51
<i>Human Capital and Research</i>	80
<i>Infrastructure</i>	71
<i>Market sophistication</i>	43
<i>Business sophistication</i>	50
<i>Knowledge and technology outputs</i>	52
<i>Creative</i>	35

Source: World Intellectual Property Organization, 2022.

Although these data may seem discouraging at first glance, this information is more significant when we analyze Vietnam's performance in the context of Southeast Asia (table 2). Beyond the case of Singapore, which is different due to the uniqueness of its political structure -it is a city-state-, its economic structure -first, as a platform for the export of goods and now also services and the digital economy- and its historic route towards economic development, Vietnam has made adequate progress on the path of innovation. In Southeast Asia, Malaysia has the best position in the index regarding the pillars of innovation. However, this country decreased by four places between 2013 and 2022. On the other hand, Vietnam was the country that increased the most places, rising 28 sites, followed by the Philippines and Cambodia.

In the context of Southeast Asia, Vietnam is one of many countries that has experienced significant growth in its capabilities to advance on the innovation path. This fact may have originated in a vision of shared economic growth between neighboring countries. In a regional context, innovation dynamics are generated by sharing similar characteristics. An example is the Philippines. This country advanced 31 places between 2013 and 2022. In this regard, the Philippine government has created a legal framework to promote innovation (such as Republic Act No. 11293 or Philippine Innovation Act), has established medium-term goals (the National Innovation Strategy 2023-2032), and has improved innovation governance by establishing an innovation ecosystem that facilitates collaboration across various platforms and provides resources and opportunities for innovative ideas (National Economic and Development Authority, 2020, 2023). Thus, the innovations could be concretized in products and services. At the same time, the Philippines takes advantage of the regional advantages derived from being part of ASEAN.

Regarding patent applications, according to the World Intellectual Property Organization, Vietnam ranked 44th in the world in 2021. Compared to other Southeast Asian countries, Vietnam's place is ordinary. Singapore ranked 24th, Malaysia 37th, Thailand 39th, Indonesia 42nd, and the Philippines 54th (World Intellectual Property Organization, 2022).

Table 2
Global Innovation Index, 2013, 2017 and 2022, ASEAN countries

<i>Country</i>	<i>2013</i>	<i>2017</i>	<i>2022</i>
Indonesia	85	87	75
Philippines	90	73	59
Malaysia	32	37	36
Singapore	8	7	7
Thailand	57	51	43
Vietnam	76	47	48
Brunei Darussalam	74	71	92
Cambodia	110	101	97
Lao People's Democratic Republic	-	-	112
Myanmar	-	-	116

Source: World Intellectual Property Organization, 2013, 2017, 2022.

Finally, the Global Knowledge Index 2022 evidences a similar situation. In this index, Vietnam ranks 67 worldwide out of 132 countries evaluated. According to this report, the areas of improvement are the investment in telecommunication services as a percent of GDP, the natural hazard exposure, the participation rate in formal and non-formal education and training, the average documents per researcher, and the inbound mobility rate. Vietnam ranks 55th in pre-university education, 52th in technical and vocational education and training, and 111th in Higher Education. Regarding Research, Development, and Innovation, Vietnam is 74th; Information and Communication Technologies is 76th; Economics is 41th; Enabling Environment is 68th. According to the prestigious QS Ranking, only three Vietnamese universities are among the 200 most important in Asia. These universities are Ton Duc Thang University, in Ho Chi Minh City, in 138th place; Duy Tan University, in Da Nang, in 145th place; and Vietnam National University, in Hanoi, in 162nd place (Elsevier and QS World University Ranking, 2023). Therefore, Vietnam's better overall performance stems from a more stable macroeconomic environment, robust financial structures, and favorable international competitiveness business environment. The key factors for innovation are infrastructure, health services, the basic education system, the development of the financial market, and the further expansion of the domestic market. In brief, the Vietnamese government has built a strong backdrop for innovation. Still, the actors in this play, which include training specialized human resources, the commercialization of research and development activities, and the presence of research-oriented laboratories and universities, must advance faster to represent that work better. Therefore, there is still a long way to go.

This road is still long to go if we consider the gender gap in scientific and technological activities. As the UN Women (2021) points out, despite significant advances in reducing the gender gap, critical challenges remain. The disparity increases at the graduate level in tertiary education, where women only account for 28% of doctoral degrees; the ratio of women in leadership positions in the education sector is inverse to their proportion in the workforce —13% of Department Directors, and 34.8% of Vice Directors—. The gender-based segregation and occupational streaming in vocational training and occupations are along gender stereotypical lines, which limits both women's and men's access to the full range of jobs. In addition, the field of study of Vietnamese women's university education still needs to be similar to men's in specific areas of knowledge such as engineering and ICTs (table

3). Also, female researchers, as a percentage of total researchers in 2017, accounted for nearly half (44.8%) of the complete human resources in research and development (UNESCO, 2019). Around 20% of principal investigators are women (Pham, 2022). Finally, in 2020, the percentage of female scientists who obtained the title of associate professor and the full professor was 23.7 and 15.3, respectively (Minh et al., 2022).

Table 3
Vietnam, share of female tertiary graduates by field, 2018 (%)

<i>Agriculture</i>	<i>Engineering</i>	<i>Health & Welfare</i>	<i>Natural Sciences</i>	<i>ICTs</i>	<i>Social Sciences & Journalism</i>	<i>Business, Admin. & Law</i>	<i>Arts & Humanities</i>
53.0	37.1	58.7	50.6	26.4	57.2	59.5	60.0

Source: UNESCO (2019).

The paradox is that this disparity exists despite government efforts to advance gender equality in the scientific field. Since its foundation in 1945, the Constitution of the New Democratic Republic of Vietnam (DRV) guaranteed women the “same political, economic, cultural, social and family rights as men,” and the leaders of the new Republic declared that Vietnamese women were no longer doomed to live their lives as the ‘slaves of slaves,’ but would be recognized as equal members of a newly independent nation (Pettus, 2003). At present, the government thinks women’s participation in scientific activities is vital for Vietnam’s industrialization and economic modernization. Consequently, many policies encourage female researchers’ activities (Minh et al., 2022). So, gender equality in science and technology is one of eight critical areas regulated by the law on gender equality issued in 2006 (Pham, 2022). For example, there are policies ordering flexible forms of training suitable to the conditions and circumstances of female employees who are raising children and providing monetary support, accommodations, childcare, and preschool when female employees bring their children to the training and retraining institutions (Minh et al., 2022).

3. The traditional role of women in Vietnamese society and its impact on their participation in scientific activities

Gender difference is a fundamental factor that makes it more difficult for women to conduct scientific research than men. This complex situation is not unique to Vietnam or East and Southeast Asian countries. On the contrary, it is a global challenge and a world concern included in the 2030 Agenda, “a plan of action for people, planet and prosperity” (United Nations, 2024). The Agenda 2030, launched in September 2015, proposed ambitious goals for the international community to achieve sustainable development. This agenda, commonly known as the Sustainable Development Goals (SDGs), aims to end poverty, confront climate change, and ensure peace and prosperity for all by 2030 (Struckmann, 2018). The SDGs are a recognition of inequalities in the world and the pressing need to reduce and eliminate these inequalities, starting with the “tyranny of poverty.” Also, the SDGs emerge as a valuable tool for gender mainstreaming because it calls for shifts in international assistance infrastructure that favor locally led interventions (Novovic, 2023).

On the other hand, the barriers that limit women’s participation in scientific activities are both physical and ideational. Physical barriers can be measured, contrasted, and eventually overcome through specific actions. Regarding those barriers, countries like Vietnam have promoted particular measures to reduce the gender gap. Among these measures, institutional support and female-friendly workplaces significantly increase the success rates of grant applications among female academics (Jung, 2012). Other practical steps to remove these barriers include continued funding for women academics through mentorship programs (Mejia, 2010); the restructuring of director positions and opportunities for advanced career development with more flexible tenure and promotion pathways for women (Mejia, 2010; Zakaib, 2011) and the extension the age standards to apply for senior scientific career prizes (Ma et al., 2018). Also, coaching and accompanying to make a more informed decision for family and career, creating more family-friendly meeting times and childcare support, and allowing remote working and compensated paternal leave for both fathers and mothers are fundamental actions (Yip et al., 2020).

However, mental barriers are more complicated to measure, contrast, and overcome. Within this type of mental barrier are embedded stereotypes in particular cultural contexts. Gender stereotypes were crucial in explaining

the difference between women's and men's scientific achievements (van den Besselaar & Sandström, 2016). In particular, the traditional role of women in Vietnamese society is critical to limiting and decreasing the chances of participation and success in scientific activities by women. Confucian values persisted in Vietnam long after the withdrawal of the Chinese empire in 938 (Chiricosta, 2010). In ancient Vietnam, under the paradigmatic vision of Confucianism, a woman lived only within the confines of her house, and her roles were labor and procreation; so, women did not have the right to study, and during nine centuries of the Chinese Mandarin system influence, only one woman, Nguyễn Thị Duệ (late 1500s - early 1600s), held the civil service exam (Ngoc, 2016). Under French colonial rule, Vietnamese women began to press for an extension of their rights. They played an active role in many areas of Vietnamese society under the DRV, including the struggle for national liberation (Lockhart & Duiker, 2010).

In this context, gender stereotypes reflect mental barriers. These mental limitations are misconceptions of family, community, and society that generalize the traditional idea that 'men build the house, women build homes.' Confucianism thought are the pillars of these stereotypes. Confucianism has always been a personal philosophy of inner growth in Chinese tradition and an ideological guide for designing political institutions and government actions (Cheng, 2011). Generally, Confucianism has been used as a legitimizing resource for the political, social, and economic structures of an eminently agricultural society, providing the foundations of the worldview of Chinese civilization (Fung, 1997). The *raison d'être* of Confucius's thought was the search for a political solution to the prevailing chaos of the time in which he lived. In short, it is possible to affirm that Confucius sought to generate an ethical system that would answer the political challenges of his time. As Yao has observed (2000), the central concern of Confucius was the fundamental principles of humanity. He believed that these values were the root of social relationships, the grounds of the stability, peace, and prosperity of the state, the family, and individuals. In consequence, "He developed his ethics around two central theses; that goodness can be taught and learned, and that society can only be in harmony and at peace under the guidance of wisdom" (Yao, 2000, p. 46). On the other hand, the link between Confucianism and sexism can be seen through the convergence of three cultural imperatives: the familial virtue of filial piety, ancestor worship, and the continuity of the family line (Li-Hsiang, 2010). In contemporary Vietnam the wife continues to be

the main person responsible for housework and care of the children and the elderly while the husband is considered to be more suitable for production, guest reception and to communicate with the authorities on behalf of the family (Minh, 2023).

As a 'code of conduct,' Confucianism is a complex system of ethical principles that has set the models of living and standards of social values and attitudes toward correct personal behavior and the individual's duties to society (Chiung-Tzu, 2006). Vietnamese social organization was molded by "thousand years of Chinese domination" of the first millennium AD, including the Confucian perspective of the world. So, socially, this conceptualization meant domination by the male and the father, patrilineal succession, and clan organization (Whitmore, 1984). Ho Chi Minh, an independent leader and founding member of the Communist Party of Vietnam, incorporated some fundamental political principles of classical Confucianism into his specific governmental vision (Bui, 2013). Confucius' followers developed a series of ceremonial "rites" for women that encouraged and taught feminine virtues desirable from the male perspective, such as "quietness, obedience, good manners, personal neatness, industry, ability to cook, to spin, and to sew, respect for the husband's parents, kindness to the husband's brothers, and courtesy to the husband's friends" (Gao, 2003, p. 115).

As Hoa (2017) pointed out, this assumption promotes the idea that women's significant responsibilities are associated with household work and being primarily responsible for caring for children and older people. As for the husband, he takes care of his career and earns the money. Consequently, many Vietnamese women who participate in research activities often make their work harder because they have to spend time on both research and housework. Hoa (2017) also warns that gender discrimination as 'respect for men, contempt for women' still holds in some areas of society. Therefore, unfortunately, many Vietnamese doubt women's capacity in research activities. This mental frame limits access to higher education and affects female research selection, evaluation, and promotion.

Another essential element is the distinction between men and women in scientific research. Considering that Confucian thought still influences society, women must face prejudices about their research capacity. Among the people, there are still many people who look down on women. The influence of the thought that despises women in society has caused many people to lack confidence in women, disregarding women's contributions to society

and, primarily, in scientific research. Those ideas impact the evaluation of female researchers' scientific proposals and research works. Also, women need more time to participate in scientific research because they struggle to balance family and the responsibilities of a demanding scientific career. In this sense, female scientists have to be pregnant and give birth. So, they have to spend a lot of time doing housework and taking care of the family, not only the children but also elderly parents. Consequently, family obligations reduce their promotion possibilities. In addition, it is difficult for women to spend much time on scientific research because they should do two works: take care of the family and carry out their scientific activities. Also, many husbands did not support their wives to participate in scientific research. In addition, women in scientific research also face obstacles from male and female colleagues who privilege the role of women as wives and mothers rather than as scientists. Finally, women's retirement age is five years earlier than men's, which is another disadvantage to participating in scientific activities because this affects women's training, research time, and talent development.

4. Conclusions

In 1993, the World Bank published a report that although Vietnam faced a long transition from its status as a low-income economy to becoming another Asian tiger, the continued liberalization of the economy, the expansion of the private sector, and the dissolution of the last remnants of a socialist-inspired state economy ensured that Vietnam was on the right track. According to the authors of this report, in the not-distant future, Vietnam was highly likely to join other countries in East and Southeast Asia, which had reached high levels of development (World Bank, 1993). However, despite this promising report, the reality is that the Vietnamese government and society still have a long way to go to guarantee better living standards for the population that will allow the country to be an upper-middle-income nation and, eventually, reach levels of development comparable to the profound transformations and advances made by the economies known as the Asian tigers. Moreover, any economic or social development will only be complete if the government and society create the conditions that women can fully participate in scientific and technological activities.

This exploratory article summarizes that, in recent years, Vietnam has favored the creation of conditions to impulse a solid economic performance to

consolidate a national innovation system. Also, these conditions have reduced poverty levels, promoted a generalized primary education, and generated adequate health services for its inhabitants. Likewise, the government has successfully transformed the economic structure, transitioning from a Soviet-inspired planned economy model to a market-oriented model. At present, Vietnam's economy is profoundly and internationally connected. As a result, the export capacity of its companies has notably increased. The continuously growing national market and adequate promotional activity to attract FDI have complemented these noteworthy achievements. An essential element of this development path has been the political stability that has allowed us to draw a medium- and long-term vision that, with adequate strategic planning, is profoundly transforming the people's economic, political, and social reality. At the same time, the government has undertaken a series of measures to reduce the gender gap in different fields, including women's scientific and technological activity.

Nevertheless, the task still needs to be finished. Increasing the population's capabilities to participate in economic activities with more added value is essential. As Fagerberg and Srholec (2017) demonstrate, increasing these capabilities enhances economic growth and development. Beyond the economic benefits, the increase in development capabilities allows vulnerable populations to be incorporated to improve their access to formal education and to carry out work within scientific and technological activities. Particularly in the case of women, whose conditions to participate in scientific and technological activities are more limited and who face many structural challenges.

The most crucial challenge is to break down the mental barriers that perpetuate stereotypes about the role of women and their capabilities. These stereotypes based on a Confucian vision of society have generated essential limitations on what women should do regarding their contribution to society and what they can do based on their supposed intellectual capacities. This way of looking at the world has placed women at a substantial disadvantage if they wish to pursue an academic career linked to research. Therefore, an essential step to advance in reducing the gender gap in scientific activities that will allow consolidation of the national innovation system of Vietnam is to break down the myths and stereotypes of women. It is an essential step in which the government and society must participate jointly.

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