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Gender and Innovation in Southeast Asia: The Moderating Role of Absorptive Capacity

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Abstract

This study examines how female managers or owners impact a firm's innovation. Moreover, this research examines the role of absorptive capacity with R&D as a proxy in moderating the female managers/owners-innovation relationship. This study uses firm-level data from the World Bank Enterprise Surveys. The final sample consists of 4,438 firms in manufacturing industries in 2015–2016 across nine Southeast Asian economies (Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand, Timor Leste, and Vietnam). The research adopts the multilevel mixed-effects logistic regression technique to deal with the hierarchical data structure issue, which is not addressed in the traditional binary choice regression technique (logistic or probit regression). The results show that firms led by female managers have a higher possibility to innovate. Female ownership is also positively associated with innovation propensity. The positive effects of female managers on a firm's innovation are enhanced by R&D activities. Besides, R&D also strengthens the positive effects of female owners on a firm's innovation. This study contributes as probably the first to develop the theoretical argument that R&D can positively moderate the gender–innovation link. Furthermore, from an empirical standpoint, the current study contributes as the first research on this topic in the Southeast Asian region.

Keywords: Absorptive Capacity, Female Managers, Female Owners, Innovation, Southeast Asia

JEL Classification Code: J16, O14, O32

1. Introduction

Innovation is one of the main drivers of firms' competitive advantages in the knowledge economy of the 21st century (Chen et al., 2018; Eriksson, 2014; Jang et al., 2019; Kittikunchotiwut, 2020). An increasing amount of research has suggested that innovation is driven by many factors (e.g., R&D, human capital, internationalization, institutions) (Griffith et al., 2004; Jiang et al., 2016; Krammer, 2019; Nguyen et al., 2020; Nguyen, 2020). However, the gender

effects regarding innovation performance are not yet fully understood (Chen et al., 2018; Dohse et al., 2019; Liao, et al., 2019). Indeed, females are increasingly becoming a vital factor in firm governance and ownership (Dohse et al., 2019; Liao et al., 2019). More specifically, there has been an increasing rate of female directors in the firms' boards of directors (Chen et al., 2018; Nielsen & Huse, 2010). Besides, female ownership of businesses has been increasing in some countries (Dohse et al., 2019). Thus, there is a need to investigate this under-researched field.

This study focuses on the context of Southeast Asian countries. There are approximately 61.3 million females who own and operate businesses in Southeast Asian countries (United Nations ESCAP, 2018). There is also a relatively high rate of firms with female ownership in Southeast Asia. In particular, the proportion of female ownership is 69% in the Philippines, 64% in Thailand, and 51% in Vietnam (United Nations ESCAP, 2018). However, the majority of women entrepreneurs in this region are trapped in informal sectors and lower value-added activities (United Nations ESCAP, 2018). Given this setting, it is interesting to examine whether female managers or owners

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impact a firm's innovation, which formulates the first objective of this study.

Moreover, it is widely acknowledged that R&D is vital for innovation (Crépon et al., 1998; Love & Roper, 2015). R&D plays a dual role in innovation activities at the firm level by generating new knowledge for innovation and building up absorptive capacity (Cantner & Pyka, 1998; Cohen & Levinthal, 1989; Leahy & Neary, 2007; Oltra & Flor, 2003). Hence, it is also noteworthy to examine whether the absorptive capacity gained from R&D activities can strengthen the gender-innovation relationship, which formulates the second objective of this study.

The study endeavors to make three contributions. First, while most studies have only tended to focus on the direct impacts of female managers or owners on firms' innovation (Chen et al., 2018; Dohse et al., 2019), not much is known about the influence of other variables on the female managers/owners-innovation relationship. In particular, this paper contributes to the absorptive capacity literature by arguing that R&D can positively moderate the gender-innovation link. Indeed, this paper contributes as probably the first study on this unexplored theme.

Second, regarding research methods, this research utilizes a multilevel mixed-effects logistic regression to address the naturally occurring hierarchies of the data set covering a wide scope of industries and countries. Thus, this method of estimating binary dependent variables is more advantageous than the traditional logistic regression in dealing with the hierarchical data structure issue (StataCorp, 2017). Despite this interest, no research has employed this method to investigate the gender-innovation nexus. Therefore, this paper fills this gap regarding empirical methods.

Third, from an empirical standpoint, this study concentrates on a less-researched context (i.e., Southeast Asia). While there have been attempts to investigate the role of female managers and owners in the U.S. (Chen et al., 2018) or Canada (Rosa & Sylla, 2018), little has been done to examine this research topic in the Southeast Asian context. As the authors know, the current research contributes as the first study on this topic in the Southeast Asian region. Therefore, this paper makes a contribution to the limited gender and innovation literature in emerging and developing countries.

The remainder of the study is structured as follows. The next section reviews the literature on the role of gender in innovation and the moderating impact of R&D in the gender-innovation nexus. Section 3 describes the data and empirical strategy. Section 4 presents the results and analyses the effects of female managers/owners on innovation and the moderating role of R&D. Lastly, section 5 concludes the paper and suggests some implications for practice.

2. Literature Review

2.1. Gender and Innovation

Innovation decisions are taken based on a set of internal and external factors (Audretsch et al., 2020). A rich literature has been published on the role of females in the business world in general and in firm innovation in particular (Belghiti-Mahut et al., 2016; Carli & Eagly, 2001). Previous literature reveals contradictory views on the role of females in firm-level innovation. While a strand of literature posits that females are negatively associated with innovation outcomes (Charness & Gneezy, 2012; Stephan & El-Ganainy, 2007), others advocate the positive impact of females on innovation (Dezsö & Ross, 2012; Rosa & Sylla, 2018). Women may be negatively related to innovation outcomes for at least two reasons. First, women have fewer opportunities to research and work equally with men, and they also have fewer opportunities to participate in national organizations, academies, research departments as well as scientific organizations (Busolt & Kugele, 2009; Prpić, 2002). Therefore, women often lack funding, experience, time, recognition and have less influence on the scientific world (Dohse et al., 2019). As Stephan and El-Ganainy (2007, p. 486) suggested, "Women are less likely to disclose (than) are men, less likely to patent, and less likely to engage in entrepreneurial activity, such as starting a company or serving on a scientific advisory board".

Second, females are generally considered more risk-averse than males in the literature (Charness & Gneezy, 2012; Palvia et al., 2015). Moreover, they are more likely to defer innovation if the environment is perceived as more uncertain and risky (Belitskiet al., 2016; Estrin & Mickiewicz, 2011). Innovation is generally considered risky activities. As being risk-averse, female managers have a lower propensity to take risks when there are new ideas or suggestions for innovation within the organization (Millward & Freeman, 2002). Hence, this unique gender characteristic of females in combination with the role of managers may limit the possibility of innovative behavior (Millward & Freeman, 2002).

The extant literature has also mentioned several mechanisms on how female involvement in management and ownership can be constructive to firm innovation (Abrahamsson, 2002; Dezsö & Ross, 2012; Dohse et al., 2019). Abrahamsson (2002) argued that female managers may not follow the traditional gender order. As a result, they can make changes to organizational structures that support firm-level innovation. The female management style increases intrinsic motivation and creativity, shares knowledge, and develops new ideas (Dohse et al., 2019). Moreover, the feminine management style can lead to cooperation and collaboration among employees, which ultimately results

in enhanced innovation (Dezsö & Ross, 2012; Dohse et al., 2019). The empirical literature shows some support for the positive role of female management on firm-level innovation. For example, Dezsö and Ross (2012) used panel data from 1500 firms in S&P to examine whether the highest management team consisting of female representation can improve innovation. The finding shows the positive role of the representation of women in management in innovation outcomes. Similarly, Chen et al. (2018) used data from the U.S. to study whether female board representation is related to innovation at the firm level. The result reveals that firms with female directors achieve greater innovative success.

Based on the above arguments, the following hypothesis is developed:

H1: *Female managers have a higher possibility to innovate compared with their male counterparts.*

The effect of female ownership on firm innovation can be explained by the “glass ceiling” perspective. This perspective states that there exists an invisible barrier for women and minority groups, which hinders their efforts in getting higher positions in the corporate ladder (Carli & Eagly, 2001; Ridgeway, 2001). The barrier of the glass ceiling is the lack of support networks in the workplace, which makes females tend to give up salaried jobs and start their own business, especially for female employees with high creativity and innovativeness (Dohse et al., 2019). Therefore, this is a good reason for female owners to introduce innovations much more than male ones (Dohse et al., 2019). Furthermore, women owners often have more responsibilities, time, and opportunities to get potential benefits from innovation (Dohse et al., 2019). There have been several studies examining the role of female ownership in firm innovation empirically. For example, Rosa and Sylla (2018) employed data from “Statistics Canada Survey on Financing and Growth of Small and Medium Enterprises” in 2011 and 2014 and “Statistics Canada’s Linkable File Environment” to compare the innovation performance of SMEs with female and male ownership. The finding shows that firms with majority female ownership have more likelihood to innovate than those with majority male ownership. In the same vein, Dohse et al. (2019) used firm-level data from over 100 economies to investigate whether female owners perform innovation better than their male counterparts. The result shows that female owners are better at innovation than male ones.

Based on the above arguments, the following hypothesis is proposed:

H2: *Female owners have a higher possibility to innovate compared with their male counterparts.*

2.2. The Moderating Role of Absorptive Capacity

This study will investigate how R&D acts as the moderator in the gender–innovation nexus following the absorptive capacity perspective. Cohen and Levinthal (1990, p. 128) defined absorptive capacity as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends”. This research proposes that R&D can strengthen the gender–innovation link for several reasons. First, R&D is positively linked with innovation (Crépon et al., 1998; Love & Roper, 2015). R&D could generate new knowledge, acting as the background for innovation. In particular, employees with high R&D skills as well as R&D resources may increase the overall absorptive capacity of a firm to assimilate external knowledge, which results in higher innovation (Becker & Dietz, 2004; Griffith et al., 2003; Tsai & Wang, 2008). Over the past decades, most research in R&D and innovation has emphasized the dual role of R&D investment in innovation activities at the firm level: (i) building up absorptive capacity and (ii) creating new knowledge for developing innovations (Cantner & Pyka, 1998; Cohen & Levinthal, 1989; Leahy & Neary, 2007; Liu et al., 2021; Oltra & Flor, 2003).

Second, with R&D activities, firms can increase their technological knowledge base, which raises the absorptive capacity of a firm. This ultimately amplifies the positive contribution of female managers (i.e., optimizing organizational structures to support innovation, or raising employees’ intrinsic motivation and creativity to develop new ideas with female management style (Dohse et al., 2019) and female owners (i.e., women owners often have more responsibilities, time, and opportunities to get potential benefits from innovation (Dohse et al., 2019)).

In view of these arguments, this study suggests that R&D activities can increase a firm’s absorptive capacity, which can strengthen the positive role of female managers or ownership in firm innovation in Southeast Asia. Therefore, the following hypothesis is proposed:

H3: *R&D moderates the female managers–innovation relationship positively.*

H4: *R&D moderates the female ownership–innovation relationship positively.*

3. Research Methods

3.1. Data

This research uses survey data from the World Bank Enterprise Surveys (ES), covering more than 164,000 firms in 144 countries (World Bank, 2021a). The ES employs standardized survey methods that help monitor, compare,

and analyze firm behavior and performance as well as the investment climate of developing and emerging economies around the world (Ayyagari et al., 2014; World Bank, 2021b). This study focuses on female managers and owners in the context of the Southeast Asia region. In particular, this paper utilizes the survey data from the ES for nine Southeast Asia countries (Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand, Timor Leste, and Vietnam) in 2015–2016. The research only includes manufacturing industries (International Standard of Industrial Classification (ISIC) codes range from 15 to 37). After excluding outliers, the data set comprises 4,438 observations across 23 manufacturing sectors.

3.2. Variables

Dependent variable: The dependent variable is *Innovation*, which indicates the introduction of product innovation of a firm (Dohse et al., 2019; Nguyen-Van & Chang, 2020b). In this research, *Innovation* is a dummy variable, which is equal to “1” if the firm answered “Yes” to the question “During the last three years, has this establishment introduced new or significantly improved products or services?” and is equal to “0” otherwise.

Independent variables: *Female top manager* and *Female ownership*. Following previous studies (Dohse et al., 2019; Millward & Freeman, 2002), *Female top manager* is operationalized as a dummy variable. It is coded as “1” if the firm answered “Yes” to the question “Is the Top Manager female?”. If the firm answer “No” to this question, it is coded as “0”.

Following prior studies by Dohse et al. (2019) and Rosa and Sylla (2018), *Female ownership* is operationalized as a dummy variable. It is coded as “1” if the firm answered “Yes” to the question “Amongst the owners of the firm, are there any females?”. If the firm answer “No” to this question, it is coded as “0”.

Moderator: R&D. Following previous research by Becker and Dietz (2004) and Chrisman and Patel (2012), R&D is operationalized as a dummy variable. It is coded as “1” if the firm answered “Yes” to the question “During the last three years, did this establishment spend on formal research and development activities, either in-house or contracted with other companies, excluding market research surveys?”. If the firm answer “No” to this question, it is coded as “0”.

Control variables: Five popular control variables on determinants of innovation are employed in this research (Jiang et al., 2016; Nguyen-Van & Chang, 2020a; Xie et al., 2019). First, this study controls for foreign ownership (*Foreign*), which is measured as the percentage of capital owned by private foreign individuals, companies, or organizations (Adu-Danso & Abbey, 2020; Cui et al., 2016). Second, *Firm age* is the number of years since the firm’s

establishment, expressed in logarithm (Berrone et al., 2010; Jiang et al., 2016). Third, the research also controls for *Firm size*, which is calculated as the logarithm of total employees of a firm (Anderson & Reeb, 2003; Jiang et al., 2016). Fourth, a categorical variable (*Industry*) is constructed, consisting of 23 manufacturing sectors. Finally, a categorical variable (*Country*) is constructed to represent nine Southeast Asia countries.

3.3. Empirical Strategy

Almost traditional statistical analyses suppose that all observations are independent. It means that subjects’ responses are not related to each other. This assumption might be rational with random data from a large group (McCoach, 2019). Nevertheless, when using data from naturally occurring organizational units (i.e., schools, firms, countries), respondents have some relatedness with each other because they are in the same clusters (Hox et al., 2017; McCoach, 2019). In this study, the data has a hierarchical structure. More specifically, naturally occurring hierarchies include firms within industries and industries within countries. The dependent variable (*Innovation*) is constructed as a dummy variable, so it is common to use a binary choice regression (i.e., logistic or probit regression). However, the above traditional binary choice regression technique does not take into account the non-independence or hierarchies of the data set. To solve this hierarchical problem, a multilevel mixed-effects logistic regression is employed to fit a mixed-effects model of binary responses (StataCorp, 2017). This method is estimated by the *melogit* command using the Stata statistical software. The *melogit* procedure reports a likelihood-ratio test to compare the multilevel mixed-effects logistic regression with the traditional logistic regression, and a significant test result means that the multilevel mixed-effects logistic regression is better than the traditional logistic regression (StataCorp, 2017).

4. Results and Discussion

4.1. Descriptive Statistics

The descriptive statistics is provided in Table 1. 23% of the firms in the sample conducted innovation activities. More than 29% of firms had female top managers in their management boards, while the percentage of female ownership was higher (i.e., approximately 43% of firms with female ownership). Furthermore, 13% of firms in the data set invested in R&D.

The results of the correlational analysis are presented in Table 2. Because all correlation coefficients are smaller than 0.5, it is unlikely to encounter multicollinearity problems (Dormann et al., 2013).

Table 1: Descriptive Statistics

Variable	Obs.	Mean	S.D.	Min	Max
Innovation	4.365	0.230	0.421	0	1
Female top manager	4.395	0.293	0.455	0	1
Female ownership	4.330	0.428	0.495	0	1
R&D	4.353	0.129	0.335	0	1
Foreign	4.410	10.178	27.389	0	100
Firm age	4.387	2.746	0.663	0	5.081
Firm size	4.438	3.909	1.468	0	9.903

Table 2: Pairwise Correlations

	Innovation	Female Top Manager	Female Ownership	R&D	Foreign	Firm Age	Firm Size
Innovation	1						
Female top manager	-0.0079	1					
Female ownership	0.1056***	0.4934***	1				
R&D	0.3944***	-0.0044	0.0844***	1			
Foreign	0.0372**	-0.0626***	-0.0317**	0.0846***	1		
Firm age	0.0592***	0.0143	0.0428***	0.0729***	-0.0557***	1	
Firm size	0.1332***	0.0102	0.06***	0.2398***	0.3227***	0.1764***	1

Note: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

4.2. Empirical Results

The multilevel mixed-effects logistic regression estimation results are presented in Table 3. The direct effects of female managers and owners are estimated in Models 1 and 2 respectively. Besides, Models 3 and 4 present the role of R&D in moderating female managers/owners-innovation nexus respectively. Accounting for the hierarchical structure problem, the likelihood-ratio tests contrasting the multilevel mixed-effects logistic regression with the traditional logistic regression show highly significant results. This implies that the multilevel mixed-effects logistic regression is better at estimating the data set than the traditional logistic regression.

Regarding hypothesis testing, there are four important findings. First, this study examines the influence of female top managers on innovation. Hypothesis 1, which formulates that female managers have a positive effect on innovation, is supported ($b = 0.340$, $p < 0.01$, Model 1). The finding is in line with the research of Dezső and Ross (2012) who found the positive contribution of women who severed in the management team to innovation at the firm level. Similarly, the result is consistent with the evidence from the U.S Chen et al. (2018), who found that female directors achieve greater

innovative success. The finding supports the argument that female management style may advance intrinsic motivation and creativity, share knowledge, and develop new ideas (Dohse et al., 2019). Furthermore, the finding also lends support to the idea that feminine management style can result in cooperation and collaboration among employees, which ultimately leads to enhanced innovation (Dezső & Ross, 2012; Dohse et al., 2019).

Second, Hypothesis 2 predicts a positive relationship between female ownership and innovation. This hypothesis is supported ($b = 0.320$, $p < 0.01$, Model 2). The results are in line with the findings of Rosa and Sylla (2018), who also suggested that SMEs with majority female ownership have more likelihood to innovate than those with majority male ownership. Likewise, the result agrees with the finding of Dohse et al. (2019), who found that female owners conduct innovation better than their male counterparts. This finding also supports the argument proposed by the “glass ceiling” perspective, which indicates that women lack support networks in the workplace (Dohse et al., 2019). Thus, females who have high creativity and innovativeness tend to give up salaried jobs and start their own businesses (Dohse et al., 2019). Accordingly, this is a good reason for female

Table 3: Estimation Results

Variable	Model 1	Model 2	Model 3	Model 4
Female top manager	0.340*** (0.101)		0.256** (0.111)	
Female ownership		0.320*** (0.093)		0.228** (0.102)
R&D	2.261*** (0.120)	2.287*** (0.122)	2.141*** (0.135)	2.045*** (0.164)
Female top manager × R&D			0.483* (0.258)	
Female ownership × R&D				0.496** (0.228)
Foreign	−0.004** (0.002)	−0.003* (0.002)	−0.004 (0.002)	−0.003 (0.002)
Firm age	0.290*** (0.070)	0.286*** (0.071)	0.286*** (0.070)	0.287*** (0.071)
Firm size	0.135*** (0.033)	0.125*** (0.033)	0.133*** (0.033)	0.127*** (0.033)
Constant	−3.005*** (0.349)	−2.984*** (0.339)	−2.969*** (0.353)	−2.950*** (0.340)
Country (var_cons)	0.654 (0.333)	0.590 (0.302)	0.679 (0.345)	0.596 (0.305)
Country > Industry (var_cons)	0.106 (0.049)	0.103 (0.049)	0.105 (0.049)	0.102 (0.048)
Wald χ^2	444.84	441.76	443.2	435.20
Prob > χ^2	0.0000	0.0000	0.0000	0.0000
Likelihood–ratio test vs. logit model	$\chi^2 = 270.77$ Prob > $\chi^2 = 0.0000$	$\chi^2 = 441.76$ Prob > $\chi^2 = 0.0000$	$\chi^2 = 274.16$ Prob > $\chi^2 = 0.0000$	$\chi^2 = 245.40$ Prob > $\chi^2 = 0.0000$
Obs.	4.209	4.152	4.209	4.152

Note: Standard errors are reported under each coefficient in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

owners to introduce innovations, and women owners often have more responsibilities, time, and opportunities to get potential benefits from innovation (Dohse et al., 2019).

Third, Hypothesis 3 argues that R&D moderates the female managers–innovation relationship positively. This hypothesis is supported ($b = 0.483$, $p < 0.1$, Model 3). This lends supports to the current research’s argument that R&D can raise a firm’s knowledge base, which ultimately strengthens the positive contribution of female managers by optimizing organizational structures to support innovation. Besides, the knowledge base accumulated from R&D activities can facilitate the raising of employees’ intrinsic motivation and creativity to develop new ideas by an innovation-enhanced female management style (Dohse et al., 2019).

Finally, Hypothesis 4 argues that R&D moderates the female ownership–innovation relationship positively. This hypothesis is supported ($b = 0.496$, $p < 0.05$, Model 4). This result validates the argument that the accumulated knowledge gained from R&D can raise the absorptive capacity of a firm so that this can leverage the positive contribution of female owners who often have more responsibilities, time, and opportunities to get potential benefits from innovation (Dohse et al., 2019).

5. Conclusion

This study examines whether female managers or owners have an impact on a firm’s innovation. The paper also develops theoretical arguments to explain how absorptive capacity, using R&D as a proxy, can moderate the gender–innovation nexus. Four hypotheses are tested using firm-level data from the Enterprise Surveys collected by the World Bank. The hierarchical problem of the data set covering different countries is addressed by using a multilevel mixed-effects logistic regression.

The results show that female managers have a positive association with firm innovation. Female ownership is also positively related to innovation possibility. Besides, there is a positive leveraging effect of R&D in the female managers/ownership–innovation nexus. Thus, this study contributes to an understanding of gender aspects in innovations, an under-researched field in the literature.

The paper’s results have some important implications for policy and practice. First, Southeast Asian policymakers should encourage women’s entrepreneurship by creating a favorable legal and policy environment so that female managers or owners can contribute more to firms’ innovation efforts. In particular, Southeast Asian governments should

make finance and credit available to women entrepreneurs and facilitate greater access to innovative technologies.

Second, it is necessary to foster gender-supportive systems to promote women's entrepreneurship so that it can contribute positively to innovation in women-led/women-owned firms. Specifically, female entrepreneurs in Southeast Asia should be provided more access to education and training. Moreover, discriminatory social and cultural norms should be alleviated to encourage female entrepreneurship.

Third, as R&D is important in leveraging the positive impact of female managers or ownership on innovation, there should be strong policies from Southeast Asian governments to encourage R&D activities within the firm. More specifically, policies should focus on reducing costs and risks of R&D and enhancing research infrastructure.

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