ECO-INNOVATION AND GENDER DIVERSITY: AN EMPIRICAL ANALYSIS

ABSTRACT

This paper focuses on the relationship between women's presence on the board of directors (BoD) and eco-innovation. We support the idea that the presence of women in the BoD play a key role in the development of eco-innovation. Building on existing research on critical mass (i.e., at least three women appointed to the BoD) and the "token" approach (i.e., only one or two women appointed to the BoD), we build and test some hypotheses on how the female figure in BoD can contribute to eco-innovation. The results confirm that critical mass is relevant: if at least three women are appointed to the BoD, they become a substantial group that can positively influence eco-innovation. In contrast, the mere presence of women in the BoD does not have a significant impact on eco-innovation. We tested and found support for our hypotheses on a sample of 3,316 European firms in three specific categories of environmental innovation (i.e., Air, Water, and Solid Waste).

Keywords:

Gender Diversity; Eco-Innovation; Empirical Analysis

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INTRODUCTION

Firms have started to pay more attention to the impact of their activities on society and the environment (Cillo et al. 2019) and to adopt sustainability practices (Bossle et al. 2016). They are also among the organizations that have been encouraged and are in some cases under growing political, social and public pressure to implement initiatives aimed at protecting the environment (Cillo et al., 2019; Tello and Yoon 2009). Firms pursuing sustainability should focus on innovations that produce positive results for both society and the environment (Kuzma et al. 2020), i.e., on sustainable innovation. Tello and Yoon (2009) define sustainable innovation as "the development of new products, processes, services and technologies that contribute to the development and well-being of human needs and institutions while respecting the worlds' natural resources and regenerative capacity". In a similar vein, Bos-Brouwers (2010) describe sustainable innovation as "innovations in which the renewal or improvement of products, services, technological or organizational processes not only delivers an improved economic performance, but also an enhanced environmental and social performance, both in the short and long term". A special type of sustainable innovation is represented by eco-innovations, which consist of processes, practices, and products that benefit the environment by reducing the impact arising from the use of natural resources or due to pollutant emissions (Kuzma et al. 2020; Liao, Zhang, and Wang 2019). This kind of innovation have become "the focal point to deliver evidence for the commitments of companies" to sustainability (Bos-Brouwers 2010). It enables firms to deliver environmental benefits and create social well-being (Cardoni, Kiseleva, and Taticchi 2020), to obtain a competitive advantage for the company or help to maintain it (Pellegrini et al. 2019), and to register higher growth rates (Bossle et al. 2016). Eco-innovations have thus become

one of the main contemporary topics of interest for governments, firms and scholars (Bossle et al. 2016; Cardoni, Kiseleva, and Taticchi 2020).

The implementation of sustainable innovation by firms is contingent on many factors, such as size, organizational complexity, technological capabilities, available financial resources, and importance given to sustainability (Arnold and Hockerts 2010; Baumol 2004; Pellegrini et al. 2019). Also, the presence of women in top echelon positions (board of directors (BoD), top management team, and CEO) is associated with a greater involvement in social and environmental projects (Bannò, Filippi, and Trento 2021). At the same time, female presence in the BoD is associated with greater innovative success (Chen, Leung, and Evans 2018). However, the effect on eco-innovation of women's presence in the BoD has not been sufficiently examined (Bannò, Filippi, and Trento 2021). Based on this premise, this paper addresses the role of women in fostering eco-innovation. We contribute to this growing literature and move forward our understanding of the effects of female involvement in the BoDs as a driver for eco-innovation by following the critical mass and token approaches (Kanter 1977a; Torchia, Calabrò, and Huse 2011).

THEORETICAL DEVELOPMENT

The differences of female gender characteristics with respect to those of men are largely associated with the social role, the traditional role, and the cultural role of women in societies (Nielsen e Huse 2010; Torchia, Calabrò, and Huse 2011). The effect of gender roles on behavior is important because persons are likely to internalize it to some extent and act consequently (Nielsen and Huse 2010; Torchia, Calabrò, and Huse 2011). As a result, each gender is inclined to reflect expectations, even if behavioral differences among leaders are supposed to be smaller than the average. Professionals are influenced both by gender roles, which are different for men and women, and organizational roles, which are not different. On the one hand, research studies

on gender differences inside organizations said that there were discrepancies in behaviors and abilities in some situations. On the other hand, there seemed not to be comprehensive differences in effective managerial competence based on gender (Johnson and Powell 1994; Faccio, Marchica, and Mura 2016). These may have relevant outcomes on the functioning of the BoD and their organization and lastly condition its effectiveness (Nielsen and Huse 2010; Torchia, Calabrò, and Huse 2011). According to the social role theory, women usually give more attention to issues concerning morality and ethics and may be different from men in terms of personality characteristics, interests, and behaviors (Eagly and Wood 2016). Women on BoD may thus behave more carefully and show more consideration than men (Burgess and Tharenou 2002; Walt and Ingley 2003).

To examine the positive effects that the presence of female directors has on eco-innovation, it is important to consider the number of women on the BoD (Bannò and Nicolardi 2020; Torchia, Calabrò, and Huse 2011). In fact, the positive influence of female directors previously exposed requires that certain conditions are met (Amorelli and García-Sánchez 2020). As noted by Mathisen, Ogaard, and Marnburg (2013), it may happen that during the activities of the BoD, members tend to consider more the ideas of those representing the majority (in this case, the men), while the opinions of the minority (in this case, the women) are ignored and considered as "token" or symbols (Kanter 1977a). In addition, BoD gender diversity needs to be significant to be accepted by all BoD members and to enhance strategic decision making (Ben-Amar et al. 2013). For these reasons, the research has tried to identify the number of women needed for there to be a relevant effect on the BoD's decisions (Amorelli and García-Sánchez 2020; Torchia, Calabrò, and Huse 2011).

Kanter (1977a; 1977b) finds that members belonging to the minority ("tokens") perceive barriers in influencing the decisions of the group and this condition creates isolation, discomfort,

and self-doubt. The group with a minority member can perceive this component as less competent (Bear, Rahman, e Post 2010), thus failing to consider her/his opinion seriously (Brewer and Kramer 1985; Kanter 1977a; Lord and Saenz 1985). More recent studies confirm these results. Nielsen e Huse (2010) note that female directors, despite contributing to the decision making, are considered as "unequal BoD members", which decreases their influence and access to company resources (Amorelli and García-Sánchez 2020) and reduces "the potential positive impact of women on BoD decision-making and strategic involvement" (Nielsen and Huse 2010).

However, when the number of members of the minority rises, they are no longer considered tokens and they gain trust. The critical mass theory emphasizes the importance of reaching a key threshold. This increases the quality of group interactions because the presence of more members of the minority has positive consequences on the relation between the minority and the majority (Bear, Rahman, and Post 2010). In the case of female directors, when the critical mass is achieved, "gender ceases to be a barrier to acceptance and communication" (Amorelli and García-Sánchez 2020) and the ideas of female directors start to be listened and supported by the male directors (Konrad, Kramer, and Erkut 2008). In this way, female directors can impact more on the results (Cook and Glass 2018).

Focusing on the effect of female directors on innovation, Torchia, Calabrò, and Huse (2011) detail the positive effects on innovation considering the number of female directors: when there is only one woman, she conforms to the opinions and behaviours of the majority, not affecting innovation accordingly; when there are two female directors, there is still no significant impact on innovation, as the woman's contribution remains irrelevant; only when there are at least three women who constitute a "relevant" minority, they manage to affect the level of innovation as the BoD becomes more heterogeneous and the interaction with the majority group

becomes more effective (Torchia, Calabrò, and Huse 2011). The key importance of the critical mass of women in having a positive influence on firm commitment to innovation is confirmed by Saggese and Sarto (2019).

Also studies on the influence of female directors on sustainability have produced similar results. For example, Wei, Ding, and Kong (2017) find that one or two female directors do not produce an impact on corporate environmental investment, but when there are at least three female directors, and thus the critical-mass is reached, the impact becomes positive. Instead, (Ben-Amar, Chang, and McIlkenny (2017) find that even two female directors can affect the decision-making process regarding sustainability. This result is confirmed by Atif et al. (2021), according to which two female directors are enough to have an increase in renewable energy consumption.

In summary, we argue that female directors have a positive impact on eco-innovation. However, this influence occurs only when the critical mass (identified in at least three women) is reached as in this case women's opinions are heard, the working style of the BoD changes and the dynamics and processes of the BoD are significantly modified (Erkut, Kramer, e Konrad 2008; Konrad, Kramer, e Erkut 2008). On the contrary, when female directors are less than three, they are not able to promote eco-innovation. The first two hypotheses are therefore formulated as follows:

Hypothesis 1: The presence of just a female director has no or negative effect on the level of eco-innovation.

Hypothesis 2: The presence of at least three female directors has a positive impact on the level of eco-innovation.

METHOD

Sample, sources and variables

The sample for the analysis included 3,316 European firms. The dataset, updated as of 2017, was gathered through a merging process involving three databases: Orbis (Bureau Van Dijk), Espacenet, and European Quality of Government Index (EQI). The representativeness of the sample was evaluated to ensure that the characteristics of the selected sample were similar to those of the entire population of firms.

Table 1 reports the sources and definitions of both the dependent and independent variables that account for patent, gender and control firm and context specific effects in the proposed empirical analyses.

Dependent Variable. Following Liao, Zhang, and Wang (2019) and Johnstone et al. (2012), we measure eco-innovations as a firm's stock of patents (priority date from 2000 to 2019) selected from International Patent Classification classes related to three environmental technology areas: Air Pollution (*Air*), Water Pollution (*Water*) and Solid Waste (*Waste*).

Independent Variables. We measure female presence in the BoD in two ways. First, a dummy variable taking value 1 if a firm presents at least one woman in its BoD, and 0 otherwise (*Token*). Second, a dummy variable taking value 1 if a firm presents at least three women in its BoD, and 0 otherwise (*Critical mass*).

The models

Given the count nature of the dependent variable, for the main effect we adopted Poisson models to estimate the influence of the independent variables on the dependent variable (Greene 2018; Wooldridge 2019).

Table 1 - Definitions and sources of the variables used in the empirical analysis

Variable	Definition	Source
Dependent Variables		
Eco-innovation	Stock of sustainable patents (priority date from 2000 to 2019)	ESPACENET
Air, Water, Waste	Stock of sustainable patents (priority date from 2000 to 2019) of a specific category (Air Pollution, Water Pollution, Solid Waste)	ESPACENET
Independent gender variables		
Token	Dummy variable taking the value 1 if a firm presents one woman in its BoD, and 0 otherwise	ORBIS
Critical mass	Dummy variable taking the value 1 if a firm presents at least three women in its BoD, and 0 otherwise	ORBIS
Independent control variables		
Innovation capacity	Logarithm of stock of patents (priority date from 2000 to 2019)	ESPACENET
Firm dimension	Logarithm of turnover	ORBIS
Firm age	Number of years since firm foundation	ORBIS
Board	Total number of board members	
ROA	Net income on total assets	ORBIS
ROE	Net income on equity	ORBIS
Risk	Standard deviation of ROA on the last five years	ORBIS
Value added	Value added (euro, thousands)	ORBIS
Tangibility	Tangible assets	ORBIS
ASR	Cash flow on assets	ORBIS
RSR	Capital investments on sales	ORBIS
PSR	Long terms debts on assets	ORBIS
Context	EQI	Quality of Government Institute
Liquidity ratio	Liquidity ratio, calculated as the ratio of current assets (net of inventory) and current liabilities	ORBIS

Variable	Definition	Source
Dependent Variables		
Eco-innovation	Stock of sustainable patents (priority date from 2000 to 2019)	ESPACENET
Air, Water, Waste	Stock of sustainable patents (priority date from 2000 to 2019) of a specific category (Air Pollution, Water Pollution, Solid Waste)	ESPACENET
Industry	Categorical variable describing the industry in which the firm operates, with these levels: "Pavitt science based", "Pavitt specialised suppliers", "Pavitt scale and information intensive", "Pavitt suppliers dominated", "Pavitt other"	ORBIS

RESULTS

Table 2 shows the results. Model 1 confirms that firms with a gender-diverse BoD are more prone to develop eco-innovations and that women on the BoD have to enjoy at least three seats to play a positive role. The coefficient of the variable *Critical mass* is positive and significant at $p<0.1$, while the variable *Token* has no significant impact, although positive.

Table 2 – Results

	Model 1	**Model 2**	**Model 3**	**Model 4**
Predictors	*Log-Mean*	*Log-Mean*	*Log-Mean*	*Log-Mean*
(Intercept)	-2.6625 ***	-4.7221 ***	-3.7564 ***	-2.2983 ***
	(0.1540)	(0.2563)	(0.2735)	(0.2502)
Token	0.0192	-0.1899 **	-0.2343 **	0.3657 ***
	(0.0547)	(0.0851)	(0.1143)	(0.0885)
Critical mass	0.1655 *	-0.5135 ***	0.4351 ***	0.9617 ***
	(0.0907)	(0.1587)	(0.1594)	(0.1378)
Innovation Capacity	1.5655 ***	1.9028 ***	1.1028 ***	1.3299 ***
	(0.0296)	(0.0470)	(0.0569)	(0.0495)
Board	-0.0286 ***	-0.0224 **	-0.0104	-0.0255 **
	(0.0065)	(0.0109)	(0.0121)	(0.0107)
Firm dimension	0.1170 ***	0.1865 ***	0.1698 ***	-0.0593
	(0.0311)	(0.0496)	(0.0569)	(0.0515)
Firm age	0.0008 *	-0.0002	0.0029 ***	0.0016 **
	(0.0005)	(0.0007)	(0.0008)	(0.0007)
ROA	-0.0022 ***	-0.0006	-0.0009	-0.0035 ***
	(0.0005)	(0.0009)	(0.0011)	(0.0006)
ROE	0.0098	0.0320 **	-0.0086	-0.0307 ***
	(0.0075)	(0.0131)	(0.0139)	(0.0091)

Risk	-0.0186 ***	0.0069	-0.0106	-0.0493 ***
	(0.0048)	(0.0062)	(0.0082)	(0.0093)
Value added	0.0001 ***	0.0001 ***	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Tangibility	0.0001 ***	0.0001 ***	0.0001	0.0001 ***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Liquidity ratio	-0.0014	0.0060	0.0076	-0.0152
	(0.0077)	(0.0113)	(0.0134)	(0.0144)
ASR	-0.1069	-0.3592	-0.3800	-0.0620
	(0.1685)	(0.2624)	(0.3280)	(0.2791)
PSR	-1.0551	-5.3936 ***	0.9614	4.0292 ***
	(0.6909)	(1.2110)	(1.2721)	(0.7870)
RSR	0.0009	-0.0083	0.0016 *	0.0013
	(0.0009)	(0.0122)	(0.0009)	(0.0012)
Industry	0.0372 **	0.1294 ***	0.0918 ***	-0.1001 ***
	(0.0180)	(0.0290)	(0.0330)	(0.0296)
Context	-0.0133	0.2084 ***	-0.2127 ***	0.0404
	(0.0329)	(0.0630)	(0.0548)	(0.0502)
Observations	3316	3316	3316	3316
R^2	0.991	0.986	0.478	0.611

Note: Standard errors are in parentheses.
** p<0.1 ** p<0.05 *** p<0.01*

The control variables show interesting results. *Firm dimension* and *Firm age* are positive and significant. The coefficient of the variable *Board* is negative and significant ($p<0.01$). This implies that very numerous BoD have a negative impact on eco-innovation. Instead, the coefficients for *ASR*, *RSR* and *PSR* variables are not significant.

Finally, we also tested the hypotheses on each environmental technological area. The results for the Water Pollution (Model 3) and Solid Waste (Model 4) areas show that *Critical mass* has significant positive effect on both *Water* and *Waste*, whereas *Token* has significant negative effect for Water Pollution, while significant and positive for Solid Waste. Model 2, related to the Air Pollution area, shows that *Token* and *Critical mass* has a negative and significant effect.

DISCUSSION AND CONCLUSION

Interest in eco-innovation is increasing from both an academic and a practitioners' point of view (Bossle et al. 2016). Our analysis contributes to a better understanding of the

development of eco-innovation and may serve as a guide towards a more sustainable attitude from firms. Specifically, the study examines if and how the involvement of women in the BoD influences firms' eco-innovation.

The paper supports the idea that the number of women in the BoD play a key role in the development of eco-innovation. Findings also confirm that critical mass is relevant: if at least three women are appointed to the BoD they become a consistent group capable of influencing the BoD's decision making. The likelihood of their voices and ideas being heard increases, improving managerial dynamics and sensitivity to environmental issues and these benefits may bring enhanced eco-innovation. Instead, the mere presence of women in the BoD does not have a significant impact on eco-innovation. In line with extant literature, our results confirm that if women represent a very small minority on the BoD (i.e., one or two women), they do not affect eco-innovation. They are perceived as symbols (i.e., token effect) and this allows stereotypes to prevail damaging group dynamics and performance decisions. The barriers perceived by the minority fall as the number of women on the BoD increases (Kanter 1977a) and the interaction with the majority group lead to better results (Torchia, Calabrò, e Huse 2011).

The results of this paper have several implications on practice. Owners and directors can observe how female presence in the BoD positively impacts a firm's eco-innovation. Our results could inspire a new path for women inside businesses: increasing the number of women in BoD and increasing the number of women in important roles.

The study also have several policy implications. Our findings suggest that policymakers should consider female presence in the BoD when designing laws affecting eco-innovation and when deciding whether to participate in private firms.

References

Amorelli, María-Florencia, and Isabel-María García-Sánchez. 2020. «Critical Mass of Female Directors, Human Capital, and Stakeholder Engagement by Corporate Social Reporting». *Corporate Social Responsibility and Environmental Management* 27 (1): 204–21. https://doi.org/10.1002/csr.1793.

Arnold, Marlen Gabriele, and Kai Hockerts. 2010. «The Greening Dutchman: Philips' Process of Green Flagging to Drive Sustainable Innovations». *Business Strategy and the Environment*. https://doi.org/10.1002/bse.700.

Atif, Muhammad, Mohammed Hossain, Md Samsul Alam, and Marc Goergen. 2021. «Does Board Gender Diversity Affect Renewable Energy Consumption?» *Journal of Corporate Finance* 66 (february): 101665. https://doi.org/10.1016/j.jcorpfin.2020.101665.

Bannò, Mariasole, Emilia Filippi, and Sandro Trento. 2021. «Women in Top Echelon Positions and Their Effects on Sustainability: A Review, Synthesis and Future Research Agenda». *Journal of Management and Governance*, ottobre. https://doi.org/10.1007/s10997-021-09604-7.

Bannò, Mariasole, and Viola Nicolardi. 2020. «Women's participation on Boards of Directors: The effects on business growth and profitability». *Sinergie Italian Journal of Management* 38 (1): 161–79.

Baumol, William J. 2004. *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*. Princeton Paperbacks. Princeton, NJ: Princeton Univ. Press.

Bear, Stephen, Noushi Rahman, and Corinne Post. 2010. «The Impact of Board Diversity and Gender Composition on Corporate Social Responsibility and Firm Reputation». *Journal of Business Ethics* 97 (2): 207–21. https://doi.org/10.1007/s10551-010-0505-2.

Ben-Amar, Walid, Millicent Chang, and Philip McIlkenny. 2017. «Board Gender Diversity and Corporate Response to Sustainability Initiatives: Evidence from the Carbon Disclosure Project». *Journal of Business Ethics* 142 (2): 369–83. https://doi.org/10.1007/s10551-015-2759-1.

Ben-Amar, Walid, Claude Francoeur, Taïeb Hafsi, and Réal Labelle. 2013. «What Makes Better Boards? A Closer Look at Diversity and Ownership». *British Journal of Management* 24 (1): 85–101. https://doi.org/10.1111/j.1467-8551.2011.00789.x.

Bos-Brouwers, Hilke Elke Jacke. 2010. «Corporate Sustainability and Innovation in SMEs: Evidence of Themes and Activities in Practice». *Business Strategy and the Environment* 19: 417–35. https://doi.org/10.1002/bse.652.

Bossle, Marilia Bonzanini, Marcia Dutra de Barcellos, Luciana Marques Vieira, and Loïc Sauvée. 2016. «The Drivers for Adoption of Eco-Innovation». *Journal of Cleaner Production* 113 (february): 861–72. https://doi.org/10.1016/j.jclepro.2015.11.033.

Brewer, Marilynn B., and Roderick M. Kramer. 1985. «The Psychology of Intergroup Attitudes and Behavior». *Annual Review of Psychology* 36 (1): 219–43. https://doi.org/10.1146/annurev.ps.36.020185.001251.

Burgess, Zena, and Phyllis Tharenou. 2002. « Women Board Directors: Characteristics of the Few». *Journal of Business Ethics* 37 (1): 39–49. https://doi.org/10.1023/A:1014726001155.

Cardoni, Andrea, Evgeniia Kiseleva, and Paolo Taticchi. 2020. «In Search of Sustainable Value: A Structured Literature Review». *Sustainability* 12 (2): 615. https://doi.org/10.3390/su12020615.

Chen, Jie, Woon Sau Leung, and Kevin P. Evans. 2018. «Female Board Representation,

Corporate Innovation and Firm Performance». *Journal of Empirical Finance* 48 (september): 236–54. https://doi.org/10.1016/j.jempfin.2018.07.003.

Cillo, Valentina, Antonio Messeni Petruzzelli, Lorenzo Ardito, and Manlio Del Giudice. 2019. «Understanding Sustainable Innovation: A Systematic Literature Review». *Corporate Social Responsibility and Environmental Management* 26 (5): 1012–25. https://doi.org/10.1002/csr.1783.

Cook, Alison, and Christy Glass. 2018. «Women on Corporate Boards: Do They Advance Corporate Social Responsibility?» *Human Relations* 71 (7): 897–924. https://doi.org/10.1177/0018726717729207.

Eagly, Alice H., and Wendy Wood. 2016. «Social Role Theory of Sex Differences». In *The Wiley Blackwell Encyclopedia of Gender and Sexuality Studies*. Singapore: John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118663219.wbegss183.

Erkut, Sumru, Vicki W. Kramer, and Alison M. Konrad. 2008. «Critical Mass: Does the Number of Women on a Corporate Board Make a Difference?» In *Women on Corporate Boards of Directors*, Susan Vinnicombe, Val Singh, Ronald Burke, Diana Bilimoria, and Morten Huse, 12850. Edward Elgar Publishing. https://doi.org/10.4337/9781848445192.00028.

Faccio, Mara, Maria-Teresa Marchica, and Roberto Mura. 2016. «CEO Gender, Corporate Risk-Taking, and the Efficiency of Capital Allocation». *Journal of Corporate Finance* 39 (august): 193–209. https://doi.org/10.1016/j.jcorpfin.2016.02.008.

Greene, William H. 2018. *Econometric Analysis*. Eighth edition. New York, NY: Pearson.

Johnson, J.E.V., and P.L. Powell. 1994. «Decision Making, Risk and Gender: Are Managers Different?» *British Journal of Management* 5 (2): 123–38. https://doi.org/10.1111/j.1467-8551.1994.tb00073.x.

Johnstone, Nick, Ivan Haščič, Julie Poirier, Marion Hemar, and Christian Michel. 2012. «Environmental Policy Stringency and Technological Innovation: Evidence from Survey Data and Patent Counts». *Applied Economics* 44 (17): 2157–70. https://doi.org/10.1080/00036846.2011.560110.

Kanter, Rosabeth Moss. 1977a. *Men and women of the corporation*. Basic Books: New York.

———. 1977b. «Some Effects of Proportions on Group Life: Skewed Sex Ratios and Responses to Token Women». *American Journal of Sociology* 82 (5): 965–90. https://doi.org/10.1086/226425.

Konrad, Alison, Vicki Kramer, and Sumru Erkut. 2008. «Critical Mass: The Impact of Three or More Women on Corporate Boards». *Organizational Dynamics* 37 (2): 145–64. https://doi.org/10.1016/j.orgdyn.2008.02.005.

Kuzma, Edson, Luccas Santin Padilha, Simone Sehnem, Dulcimar José Julkovski, and Darlan José Roman. 2020. «The Relationship between Innovation and Sustainability: A Meta-Analytic Study». *Journal of Cleaner Production* 259 (june): 120745. https://doi.org/10.1016/j.jclepro.2020.120745.

Liao, Zhongju, Manting Zhang, and Xiaopeng Wang. 2019. «Do Female Directors Influence Firms' Environmental Innovation? The Moderating Role of Ownership Type». *Corporate Social Responsibility and Environmental Management* 26 (1): 257–63. https://doi.org/10.1002/csr.1677.

Lord, Charles G., and Delia S. Saenz. 1985. «Memory Deficits and Memory Surfeits: Differential Cognitive Consequences of Tokenism for Tokens and Observers». *Journal of Personality and Social Psychology* 49 (4): 918–26. https://doi.org/10.1037/0022-3514.49.4.918.

Mathisen, Gro Ellen, Torvald Ogaard, and Einar Marnburg. 2013. «Women in the Boardroom: How Do Female Directors of Corporate Boards Perceive Boardroom Dynamics?» *Journal*

of Business Ethics 116 (1): 87–97. https://doi.org/10.1007/s10551-012-1461-9.

Nielsen, Sabina, and Morten Huse. 2010. «The Contribution of Women on Boards of Directors: Going beyond the Surface». *Corporate Governance: An International Review* 18 (2): 136–48. https://doi.org/10.1111/j.1467-8683.2010.00784.x.

Pellegrini, Chiara, Eleonora Annunziata, Francesco Rizzi, and Marco Frey. 2019. «The Role of Networks and Sustainable Intrapreneurship as Interactive Drivers Catalyzing the Adoption of Sustainable Innovation». *Corporate Social Responsibility and Environmental Management*, june, csr.1784. https://doi.org/10.1002/csr.1784.

Saggese, Sara, and Fabrizia Sarto. 2019. «The role of women on board for innovation: Lessons from the high-tech companies». In *Advances in Gender and Cultural Research in Business and Economics*, 169–80. Springer Proceedings in Business and Economics. Springer International Publishing. https://doi.org/10.1007/978-3-030-00335-7_11.

Tello, Steven, and Eunsang Yoon. 2009. «Drivers of sustainable innovation: Exploratory views and corporate strategies». *Seoul Journal of Business* 15 (2): 85–115. https://doi.org/10.35152/SNUSJB.2009.15.2.004.

Torchia, Mariateresa, Andrea Calabrò, and Morten Huse. 2011. «Women Directors on Corporate Boards: From Tokenism to Critical Mass». *Journal of Business Ethics* 102 (2): 299–317. https://doi.org/10.1007/s10551-011-0815-z.

Walt, Nicholas, and Coral Ingley. 2003. «Board Dynamics and the Influence of Professional Background, Gender and Ethnic Diversity of Directors». *Corporate Governance* 11 (3): 218–34. https://doi.org/10.1111/1467-8683.00320.

Wei, Feng, Binyan Ding, and Yu Kong. 2017. «Female Directors and Corporate Social Responsibility: Evidence from the Environmental Investment of Chinese Listed Companies». *Sustainability* 9 (12): 2292. https://doi.org/10.3390/su9122292.

Wooldridge, Jeffrey M. 2019. *Introductory Econometrics*. Mason, OH: Cengage. http://public.eblib.com/choice/PublicFullRecord.aspx?p=6351340.