Interlocking Director Network and Green Innovation in Japan[1]

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1. Introduction

In recent decades, environmental degradation and climate change have emerged as significant challenges for businesses, posing risks to both society and the economy. The adoption of environmentally friendly technologies, often referred to as "green innovation" or "eco-innovation," has been recognized as a potential solution, which not only help reduce carbon emissions but also offer a competitive advantage (Kim et al., 2021). In Japan, the government has been actively promoting ecological innovation within the private sector since the 1990s and released Green Transformation Technologies Inventory (GXTI) in 2022. This initiative aims to stabilize the energy supply-demand structure and cultivate an advanced, low-carbon society through the enhancement of environmental and energy technology innovations (Kimura, 2023). Such external pressures compel businesses to embrace green innovation.

Yet, green innovation is associated with dual externalities: on the one hand, it yields positive technological spillover effects on society and the economy (Driessen and Hillebrand, 2002) and on the other hand, it incurs negative externalities, such as increased costs and risks, which dampen corporate investment incentives (Jaffe and Palmer, 1997). Moreover, the specialized capabilities required to acquire and integrate external resources for developing green technologies can further discourage investment (Barbieri, 2020). As a result, firms often resort to fostering mutual connections and cooperation (Ortiz-de-Mandojana and Aragon-Correa, 2015).

Research on social networks indicates that companies operate within networks rather than in isolation (Shropshire, 2010). The board of directors, which plays a pivotal role in corporate governance, serves as a bridge between shareholders, management, and the broader market. Many firms appoint industry leaders, experts, and key stakeholders to their boards, creating interlocking director networks (Mizruchi, 1996). Such connections can facilitate communication, enhance information flow, and encourage emulation, improving board effectiveness (Haunschild and Beckman, 1998). The potential benefits of such linkages raise a critical question: how do network resources embedded within board interlocks influence green innovation performance in Japanese firms?

To explore this question, I analyzed data from Japanese listed manufacturing companies between 2013 and 2019, focusing on green patents and board memberships. The findings suggest that firms occupying central positions or structural gaps in board networks are more likely to develop green technologies. Additionally, I examine both internal capabilities and external channels

[1] The author thanks the participants at the Academic Association for Organizational Science Annual Meeting 2025 Special Session in Hosei University, Tokyo.

through which network positions can enhance green innovation. The results indicate that firms with greater absorptive capacity and richer ties to green innovation leaders reap greater benefits from their network positions.

2. Literature Review and Hypotheses

(1) Interlocking Board Network Centrality and Green Innovation Performance

The resource dependence theory suggests that businesses cannot rely solely on internal resources to ensure their continued existence and investment sustainability; rather, they must seek out and rely on external players that can supply these essential resources (Pfeffer and Salancik, 1978). Meanwhile, social network theory posits that a company's network position refers to its placement within the network formed by its connections with other companies (Shropshire, 2010). Companies occupy different positions in the network due to their shared interlocking directors, which affects their ability to acquire information and resources and to make strategic decisions (Tsai, 2001).

Central positions within board networks significantly enhance firms' access to diverse and abundant information (Putnam, 1993), which is particularly critical for navigating the dynamic field of green innovation. Such access enriches strategic foresight, exposes firms to industry-wide strategies, and facilitates learning from both successes and failures, thereby forming a robust knowledge base for green innovation decisions (Hackbarth and Mauer, 2012). Central positions also allow firms to monitor market trends and invest in projects closely aligned with their capabilities, reducing uncertainty (Howard et al., 2017; Wang et al., 2017). Furthermore, beyond channeling sufficient information, being central in the network also provides easier access to financial resources, cutting-edge knowledge, and critical human capital. These networks serve as conduits for resource flows, attracting investments and partnerships essential for extensive green innovation projects (Koka and Prescott, 2008). Additionally, occupying central positions enhances firms' ability to recombine resources creatively—an essential factor in developing pioneering green solutions. Frequent and diverse interactions in central positions increase the likelihood of encountering complementary resources, which can be synthesized into innovative solutions (Koka and Prescott, 2008). These interactions also reduce transaction costs associated with resource acquisition and integration, accelerating innovation and enabling more ambitious green projects (Howard et al., 2017). Based on the analysis above, I propose the following hypothesis:

H1: Firms occupying more central positions in the interlocking director network tend to have better performance in green innovation.

(2) Structure Holes and Green Innovation Performance

Beyond a central network position, another advantageous structural characteristic is the presence of structural holes (Hahl et al., 2016). Structural holes, as defined by Burt (2004), represent gaps in the flow of information between unconnected firms, reflecting the richness and heterogeneity of network resources (Ahuja, 2000).

Firms occupying structural hole positions benefit from both informational and control advantages, which positively influence green innovation performance. Informational advantages provide access to unique data, enabling firms to innovate by synthesizing new knowledge from diverse parts of the network (McEvily and Zaheer, 1999). Additionally, by bridging these gaps, firms can detect opportunities and threats more quickly, facilitating the identification of potential partners and alliances (Smith-Doerr and Powell, 2010). This rapid access to information helps firms seize innovation opportunities and mitigate risks associated with green innovation activities. Control advantages, on the other hand, enable firms to exert greater bargaining power and manage resources more effectively within the network. These advantages support strategic decision-making, enhance competitive positioning, and optimize resource allocation (Zang, 2018).

The dual benefits of information and control derived from structural holes are critical for firms in the green technology sector, where adapting to rapidly evolving technologies and market practices is essential to maintaining a competitive edge (Burt, 2000). Firms leveraging extensive networks of structural holes can adapt more effectively to technological advancements and integrate eco-friendly practices. Based on this analysis, I propose the following hypothesis:

H2: Firms with richer structural holes in the interlocking director network are likely to achieve better performance in green innovation.

(3) Moderating Role of Absorptive Capacity

The moderation role of absorptive capacity is grounded in the capability of the firms with advantageous positions to transform potential innovations inspired by network configurations into actual outputs (Cohen and Levinthal, 1990). Firms equipped with high levels of absorptive capacity can conduct comprehensive feasibility studies, prototype testing, and iterative refinement processes, all of which are crucial for converting innovative ideas into viable green technologies. Research highlights the critical role of absorptive capacity in fostering innovation, particularly in eco-friendly innovation, which entails overcoming dual externalities (Ben Arfi et al., 2018). Enhanced absorptive capacity helps firms navigate the competency trap and avoid technological lockout, translating into superior innovation outputs. Tsai (2001) suggests that absorptive capability acts as a conduit, transferring valuable ideas and knowledge for green technology development, thereby enhancing cross-firm green innovation activities.

The rich information and knowledge pool, obtained by either occupying central positions or spanning structural holes positions, becomes exponentially valuable in the context of high absorptive capacity. The catalytic role of absorptive capacity is to provide the necessary tools and frameworks to effectively integrate and utilize these diverse insights (McFadyen and Cannella, 2004). With high levels of absorptive capacity, firms are not only more capable of recognizing the value of the information but also of applying it practically to develop green technologies that can lead to patentable innovations (Tsai, 2001). Thus, the synergy between advantageous network positions and substantial absorptive capacity creates a fertile environment for green innovations, resulting in increased patent applications. Based on the above analysis, the following hypothesis is proposed:

H3a: Absorptive capacity positively moderates the relationship between network centrality and green innovation performance.

H3b: Absorptive capacity positively moderates the relationship between structural hole richness and green innovation performance.

(4) Moderating Role of Connectivity with Leading Firms

Leading firms often pioneer the development and application of advanced green technologies, setting benchmarks and creating pathways for breakthrough innovations in green technology. Connections with such industry leaders enhance firms' access to superior knowledge and collaboration opportunities (Reagan and McEvily, 2003), thereby amplifying the positive effects of advantageous network positions on green innovation.

For firms centrally positioned within their director networks, connections with these top-tier innovators multiply the inherent benefits of centrality by enabling them not only to gather but also rapidly disseminate and capitalize on advanced knowledge (Shropshire, 2010), which are crucial for increasing green innovation outputs. Similarly, for firms spanning structural holes, the association with leading green innovators clarifies which bridged information is most commercially viable and technologically advanced (Burt, 2004). This selective insight helps firms prioritize their innovation efforts, focusing on initiatives that are more likely to receive regulatory approval, gain market acceptance, and achieve technological success. Based on the analysis above, I propose the following hypotheses:

H4a: Connectivity with leading firms positively moderates the relationship between network centrality and green innovation performance.

H4b: Connectivity with leading firms positively moderates the relationship between structural hole richness and green innovation performance.

3. Methods

(1) Sample and data

The method for collecting interlocking director network centrality data was adapted from Haunschild (1993) and utilized the NEEDS Company Basic Data (Board Member), which provides detailed information on the board affiliations of all publicly traded companies in Japan. Using this data, an undirected and unweighted interlocking boardroom network was constructed, where two companies were considered connected if they shared at least one board member.

To empirically test the hypotheses, this study focuses on listed Japanese manufacturing firms during the period from 2013 to 2019. Manufacturing firms were selected because their production activities have significant environmental impacts, making them subject to heightened public and governmental scrutiny compared to other industries. Data on green patents were sourced from the Green Transformation Technologies Inventory (GXTI) released by the Japan Patent Office (JPO), which categorizes green transformation technologies and provides guidance on searching for relevant patent documents (Kimura, 2023). Additional firm- and director-level variables for the sampled firms were obtained from the eol database.

(2) Dependent Variable

I employ GXTI patent applications (*GXTI*) as a proxy for green innovation performance at the firm level, as evidenced by substantial related studies. In order to address the overdispersion of patent data, I calculate the natural logarithm of the number of GXTI innovation patents plus one.

(3) Explanatory Variables

Interlocking Director Network Centrality

In social network research, four centrality measures are widely recognized: degree, betweenness, closeness, and eigenvector. Each measure captures a distinct aspect of network dynamics. To isolate the impact of firm size from board centrality on firm performance, this study adopts a methodology akin to that of Larcker et al. (2010). Firms are annually ranked into quintiles based on size, and within each quintile, they are further ranked according to each centrality measure. The highest and lowest centrality values are assigned rankings of five and one, respectively. This approach reduces the influence of outliers and enhances the interpretability of regression results, effectively controlling for the confounding effects of size on network centrality. Given the uncertainty about which centrality measure is most economically significant, this study aggregates the four measures, following Larcker et al. (2010). The Integrated Degree of Network Centrality (IDNC) is computed as the equal-weighted average of the centrality quintile ranks across the four measures, rounded to the nearest whole number, and ranges from one to five.

Structural Holes Position

The richness of structural holes (*Holes*) measures the extent of constraint a company faces within a network. When a target company serves as the sole path connecting two other companies, it is said to occupy a structural hole. The constraint score indicates the total constraint faced by the focal firm in the network. Since this metric is inversely proportional to the number of structural holes occupied by the company, the difference between 1 and constraint score is adopted as a measure of the richness of structural holes.

Absorptive Capacity

Absorptive Capacity is measured by the log-transformed R&D expenditures (in millions) plus one.

Connectivity with Leaders

Connectivity with Leaders is captured by the ratio of connections with firms which are among the highest 10 percentile of GXTI patent application of the year.

(4) Control Variables

This study introduces several control variables that may influence green innovation, drawing on previous studies (Barka and Dardour, 2015; Lu et al., 2021). The control variables include Return on Assets (ROA), where higher ratios imply better profit generation from assets, enhancing green innovation capabilities; financial leverage (Lev), measured by proportion of total debt to total assets; number of independent directors (Ind), where more independent directors, often experts and industry elites, provide advanced management advice and better supervisory functions. All the control variables are lagged by one year. Table 1 shows the descriptive data and the correlations among variables.

Table 1 Descriptive Data and Correlations

Variable	Obs	Mean	SD	Min	Max	1	2	3	4	5	6	7	8
1. GXTI	4428	0.894	1.451	0.000	7.628	1.0000							
2. IDNC	4428	2.351	1.158	1.000	5.000	0.2411*	1.0000						
3. Holes	4428	0.313	0.300	0.000	0.894	0.3290*	0.7235*	1.0000					
4. ROA	4428	0.033	0.050	-1.229	0.316	0.0093	0.0644*	0.0884*	1.0000				
5. Ind	4428	3.527	1.816	0.000	10.000	0.1839*	0.2585*	0.3144*	0.0922*	1.0000			
6. Lev	4428	0.168	0.143	0.000	0.974	0.1048*	-0.0229	-0.0124	-0.3110*	-0.0104	1.0000		
7. Absorptive Capacity	4428	20.647	3.909	0.000	27.693	0.4449*	0.2123*	0.2821*	0.0987*	0.3122*	-0.0339*	1.0000	
8. Connectivity with Leaders	4428	0.106	0.231	0.000	1.000	0.2131*	0.2553*	0.1619*	0.0249	0.1477*	-0.0158	0.1758*	1.0000

* $p < 0.05$

4. Results and Discussions

Table 2 and Table 3 showcases regression analyses exploring the relationship between interlocking board network centrality (*IDNC*) as well as structural holes (*Holes*) and green innovation performance, considering the effects of two moderators. I include fixed effects for industry and year, and present t-statistics with two-way cluster robust standard errors, clustered by firm and year.

The results from Table 2's Model (1) indicate a significant positive correlation between *IDNC* and green innovation performance, with a regression coefficient of 0.173 ($p < 0.05$). This finding supports H1, affirming that greater centrality within the board network enhances green innovation. Additionally, Model (3) of Table 3 reveals a positive and significant coefficient for the interaction term ($\beta = 0.047$, $p < 0.05$), lending support to H3a. Further, Model (5) shows a substantial positive interaction between *INDC* and connectivity with industry leaders ($\beta = 0.482$, $p < 0.05$), confirming H4a. This suggests that, among firms with similar levels of centrality, those with more extensive connections to leading firms tend to achieve superior green innovation outcomes.

Table 2 Regression Analysis: Effect of IDNC on GXTI Patent and Interaction Effects

	(1)	(2)	(3)	(4)	(5)
IDNC	0.173^{**}		-0.875^{**}		0.090
	(3.496)		(-2.911)		(1.643)
ROA	0.869	0.398	0.164	1.077	0.932
	(1.294)	(0.724)	(0.313)	(1.599)	(1.370)
Ind	0.235^{***}	0.188^{***}	0.143^{***}	0.260^{***}	0.221^{***}
	(6.175)	(6.348)	(4.899)	(7.221)	(6.122)
Lev	0.829^{*}	0.815^{**}	0.635^{*}	0.883^{**}	0.864^{**}
	(2.380)	(2.587)	(2.273)	(2.477)	(2.543)
Absorptive Capacity		0.152^{***}	0.048		
		(7.456)	(1.782)		
IDNC* Absorptive Capacity			0.047^{**}		
			(3.324)		
Connectivity with Leaders				0.779^{***}	-0.538
				(5.074)	(-1.547)
IDNC * Connectivity with Leaders					0.482^{**}
					(3.252)
_cons	-0.508^{**}	-3.054^{***}	-0.983	-0.289^{*}	-0.368^{**}
	(-3.542)	(-7.327)	(-1.741)	(-2.341)	(-2.609)
N	4428	4428	4428	4428	4428
adj. R^2	0.3375	0.4453	0.4844	0.3234	0.3555

Note: Industry and year fixed-effects are included throughout; t-statistics based on two-way cluster robust standard errors, clustered by firm and year, are shown in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Moving to the findings from Table 3, Model 1 reports a robust positive relationship between the presence of structural holes in the board network and green innovation performance, with a regression coefficient of 1.065 ($p < 0.01$). This supports H2, demonstrating that a richer diversity of non-redundant information links correlates with better innovation outcomes. Model (3) and (5) in Table 3 further show that both absorptive capacity and leadership connections significantly moderate this relationship ($\beta = 0.239$, $p < 0.01$, Model 3; $\beta = 2.310$, $p < 0.01$, Model 5), confirming Hypotheses 3b and 4b. These moderators indicate that firms well-connected with leaders or possessing high absorptive capacity leverage their network positions more effectively to enhance green innovation.

Table 3 Regression Analysis: Effect of Holes on GXTI Patent and Interaction Effects

	(1)	(2)	(3)	(4)	(5)
Holes	1.065^{***}		-4.344^{**}		0.736^{***}
	(6.481)		(-3.430)		(4.441)
ROA	0.674	0.398	0.020	1.077	0.710
	(1.095)	(0.724)	(0.041)	(1.599)	(1.142)
Ind	0.195^{***}	0.188^{***}	0.115^{***}	0.260^{***}	0.169^{***}
	(5.571)	(6.348)	(4.287)	(7.221)	(5.133)
Lev	0.827^{**}	0.815^{**}	0.536	0.883^{**}	0.837^{**}
	(2.484)	(2.587)	(1.942)	(2.477)	(2.583)
Absorptive Capacity		0.152^{***}	0.081^{***}		
		(7.456)	(4.966)		
Holes * Absorptive Capacity			0.239^{***}		
			(4.139)		
Connectivity with Leaders				0.779^{***}	0.145
				(5.074)	(0.908)
Holes * Connectivity with Leaders					2.310^{***}
					(4.656)
_cons	-0.288^{**}	-3.054^{***}	-1.543^{***}	-0.289^{*}	-0.216
	(-2.447)	(-7.327)	(-4.679)	(-2.341)	(-1.895)
N	4428	4428	4428	4428	4428
adj. R^2	0.4443	0.4945	0.5374	0.4238	0.4622

Note: Industry and year fixed-effects are included throughout; t-statistics based on two-way cluster robust standard errors, clustered by firm and year, are shown in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5. Conclusion

While current literature acknowledges that social capital enhances innovative capabilities, there has been limited focus on how advantageous network positions, specifically through embedded board social capital, influence green innovation performance. This study contributes to the intersection of corporate governance, social networks, and environmental innovation by demonstrating the crucial role of firms' positions within interlocking director network in driving green innovation. It extends the resource dependence theory by emphasizing that firms with central network positions and access to structural holes not only enhance their resource acquisition but also channel these resources towards eco-innovative efforts. The identification of absorptive capacity and connections with industry leaders as significant moderators enriches social network theory by showing how internal capabilities and external collaborations amplify innovation outcomes. From a practical perspective, this research highlights the importance for firms to strategically position themselves in networks and invest in absorptive capabilities, particularly in sectors targeted by government initiatives like GXTI. Policymakers can also leverage these insights by encouraging inter-firm collaborations and incentivizing connections with green leaders to foster broader diffusion of environmental innovations.

6. References

Ahuja, G. (2000). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, *45*(3), 425-455. https://doi.org/10.5465/apbpp.1998.27664401

Barbieri, N., Marzucchi, A. & Rizzo, U. (2020). Knowledge sources and impacts on subsequent inventions: Do green technologies differ from non-green ones, *Research Policy, 49*(2), 103901. https://doi.org/10.1016/j.respol.2019.103901

Barka, H. B., & Dardour, A. (2015). Investigating the relationship between director's profile, board interlocks and corporate social responsibility, *Management Decision*, *53*(3), 553–570. https://doi.org/10.1108/MD-12-2013-0655

Ben Arfi, W., Hikkerova, L. & Sahut, J.-M. (2018). External knowledge sources, green innovation and performance, *Technol. Forecasting Social*, 129, 210–220. https://doi.org/10.1016/j.techfore.2017.09.017

Burt, R. S. (2000). The network structure of social capital, *Research in Organizational Behavior*, 22, 345-423. https://doi.org/10.1016/S0191-3085(00)22009-1

Burt, R. S. (2004). 'Structural Holes and Good Ideas', *American Journal of Sociology*, *110*(2), 349-399. https://doi.org/10.1086/421787

Cohen, W. M. & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation, *Administrative Science Quarterly*, *35*(1), 128-152. https://doi.org/10.2307/2393553

Driessen, P. & Hillebrand, B. (2002). Adoption and diffusion of green innovations, In: Nelissen, W. & Bartels, M. *Marketing for Sustainability: Towards Transactional Policy-Making*. Amsterdam: Ios Press, 343-356.

Hackbarth, D. & Mauer, C.D. (2012). Optimal Priority Structure, Capital Structure, and Investment, *The Review of Financial Studies*, *25*(3), 747-796. https://doi.org/10.1093/rfs/hhr129

Hahl, O., Kacperczyk, A. "Olenka", & Davis, J. P. (2016). Knowledge asymmetry and brokerage: Linking network perception to position in structural holes. *Strategic Organization*, *14*(2), 118-143. https://doi.org/10.1177/1476127015624274

Haunschild, P. R. & Beckman, C. M. (1998). When Do Interlocks Matter? Alternate Sources of Information and Interlock Influence, A*dministrative Science Quarterly*, 43(4), 815–844. https://doi.org/10.2307/2393617

Haunschild, P. R. (1993). Interorganizational imitation: The impact of interlocks on corporate acquisition activity, *Administrative Science Quarterly*, *38*(4), 564–592. https://doi.org/10.2307/2393337

Howard, M. D., Withers, M. C., & Tihanyi, L. (2017). Knowledge Dependence and The Formation of Director Interlocks, *Academy of Management Journal*, *60*(5), 1986–2013. https://doi.org/10.5465/amj.2015.0499

Jaffe, A.B. & Palmer, K. (1997). Environmental regulation and innovation: a panel data study, *The Review of Economics and Statistics*, *79*(4), 610 – 619. https://doi.org/10.1162/003465397557196

Kim, I., Pantzalis, C., & Zhang, Z. (2021) Multinationality and the Value of Green Innovation, *Journal of Corporate Finance*, *69*(1), pp. 1-23. https://doi.org/10.1016/j.jcorpfin.2021.101996

Kimura, Y. (2023). Green Transformation Innovation, *RIETI Discussion Paper Series 23-E-086*

Koka, B. R., & Prescott, J. E. (2008). Designing Alliance Networks: The Influence of Network

Position, Environmental Change, and Strategy on Firm Performance, *Strategic Management Journal*, *29*(6), 639–661. https://doi.org/10.1002/smj.679

Larcker, D.F., So, E.C. & Wang, C.C.Y. (2010). Boardroom Centrality and Stock Returns, *Working Paper.* Stanford University.

Lu, J., Mahmoudian, F., Yu, D., Nazari, J. A., & Herremans, I. M. (2021). Board interlocks, absorptive capacity, and environmental performance, *Business Strategy and the Environment*, *30*(8), 3425–3443. https://doi.org/10.1002/bse.2811

McEvily, B., & Zaheer, A. (1999). Bridging ties: A source of firm heterogeneity in competitive capabilities, *Strategic management journal*, *20*(12), 1133-1156. https://doi.org/10.1002/(SICI)1097-0266(199912)20:12<1133::AID-SMJ74>3.0.CO;2-7

McFadyen M. A. & Cannella, A. A. (2004). Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships, *Acad. Manage. J.*, *47*(5), 735–746. https://doi.org/10.5465/20159615

Mizruchi, M.S. (1996). What Do Interlocks Do? An Analysis, Critique, and Assessment of Research on Interlocking Directorates, *Annual Review of Sociology*, *22*, 271-298. https://doi.org/10.1146/annurev.soc.22.1.271

Ortiz-de-Mandojana, N., & Aragon-Correa, J. A. (2015). 'Boards and sustainability: The contingent influence of director interlocks on corporate environmental performance', *Business Strategy and the Environment*, *24*(6), 499–517. https://doi.org/10.1002/bse.1833

Pfeffer, J. & Salancik, G. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York, NY, USA: Harper & Row.

Putnam, R. (1993). The prosperous community: Social capital and public life, *The American Prospect*, 13(Spring), Vol. 4.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range, *Administrative Science Quarterly*, *48*(2), 240-267. https://doi.org/10.2307/3556658

Shropshire, C. (2010). The role of the interlocking director and board receptivity in the diffusion of practices, *Academy of Management Review*, *35*(2), 246–264. https://doi.org/10.5465/AMR.2010.48463333

Smith-Doerr, L., & Powell, W. W. (2010). Networks and Economic Life. In *The Handbook of Economic Sociology* (STU-Student edition, pp. 379–402). Princeton University Press. https://doi.org/10.1515/9781400835584.379

Tsai, W. (2001). Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance, *Academy of Management Journal*, *44*(5), 996–1004. https://doi.org/10.5465/3069443

Wang, R., Gupta, A. & Grewal, R. (2017). Mobility of Top Marketing and Sales Executives in Business-to-Business Markets: A Social Network Perspective, *Journal of Marketing Research*, *54*(4), 650-670. https://doi.org/10.1509/jmr.14.0124

Zang, J. (2018). Structural holes, exploratory innovation and exploitative innovation, Management Decision, *56*(8), 1682-1695. https://doi.org/10.1108/MD-05-2017-0485

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Abstract: This study integrates resource dependence theory and social network theory to explore how two key interlocking network positions—central network position and structural holes—drive corporate green innovation. Using empirical data from listed manufacturing firms in Japan between 2013 and 2019, a country renowned for its environmental leadership, the analysis reveals that both central network positions and structural holes significantly enhance the development of green technologies. Furthermore, absorptive capacity and connectivity with industry leaders are identified as moderating factors influencing the relationship between these network positions and green innovation. Distinct from prior research, this study highlights the pivotal role of network positions in fostering corporate green innovation. The insights provided are valuable for executives looking to enhance their firms' green innovation performance and for policymakers committed to advancing eco-innovation.

Keywords: Interlocking Director; Board Capital; Network Position; Green Innovation