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The Effect of Green Digital Orientation on Employee Green Innovation in Southeast Asia

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Abstract. This study examines the effect of green digital orientation (GDO) on employee green innovation be-havior (EGIB) and investigates the mediating role of green digital capability (GDC) among manufac-turing companies in Indonesia and Singapore. A quantitative approach with an explanatory research de-sign and cross-sectional survey was employed. Data were collected from 223 manufacturing employees selected through purposive sampling and analyzed using CB-SEM. The findings indicate that GDO has a positive and significant effect on GDC, while GDC has a positive and significant effect on EGIB. In contrast, GDO does not have a significant direct effect on EGIB. The mediation analysis demonstrates that GDC significantly mediates the relationship between GDO and EGIB. These findings suggest that a digital orientation aligned with environmental objectives is insufficient to generate green innovation among employees without the digital capabilities required to translate such orientation into workplace practices. The study highlights the importance of developing GDC as a mechanism for translating firms' green digital orientation into employee green innovation behavior in the manufacturing sector.

Keywords: Employee Green Innovation; Green Digital Capability; Green Digital Orientation; Manufacturing; Southeast Asia.

1. INTRODUCTION

Digital transformation and sustainability pressures are increasingly reshaping the strategic direction of the manufacturing industry in Southeast Asia. Firms are no longer expected merely to improve productivity but also to reduce resource consumption, waste, and environmental impacts through digital technologies (De Felice et al., 2024). Indonesia and Singapore provide relevant contexts because both play important roles in regional manufacturing while exhibiting different technological and business environments. In Indonesia, manufacturing contributed 19.07% to GDP in the first quarter of 2026 and recorded annual growth of 5.04%, highlighting its substantial contribution to the national economy. Meanwhile, Singapore's manufacturing sector grew by 8.7% in 2025, with electronics representing one of the major technology-driven contributors to growth (Lennon, 2025). The scale of manufacturing in both countries underscores the need to connect digital transformation with sustainability. However, technology adoption alone does not explain how firms develop green digital orientation (GDO), strengthen green digital capability (GDC), and ultimately foster employee green innovation behavior (EGIB) as a tangible form of environmental innovation at the employee level (Rahnama et al., 2026).

Against this backdrop, GDO becomes important because it reflects the strategic direction through which firms integrate digitalization with environmental objectives (Dogbe & Marwa, 2024). However, strategic orientation does not necessarily translate into EGIB when firms lack

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the capabilities required to convert digital technologies and environmental objectives into workplace practices (Dogbe & Marwa, 2024). Manufacturing employees occupy a particularly important position because they interact directly with energy use, raw materials, machinery, waste, and production processes, creating opportunities to identify environmental improvements. Such opportunities, however, require GDC, namely the ability to utilize digital technologies and environmental knowledge to identify problems, generate ideas, and implement green solutions (Dogbe & Marwa, 2024). The central issue is therefore how a firm's green digital orientation can be translated into actual green innovation behavior among employees.

The relationship can be understood through the Resource-Based View (RBV) and Dynamic Capability View (DCV) perspectives (Barney & Arikan, 2005; Teece, 2018). RBV views internal resources and capabilities as important foundations of competitive advantage, suggesting that GDO and GDC can become strategic assets when firms combine digital technologies with environmental competencies. DCV, in turn, emphasizes how firms sense, seize, and transform resources in response to technological change and environmental pressures (Teece, 2007). Within this framework, GDO provides strategic direction, GDC represents the capability that enables firms to capture and reconfigure green digital opportunities, while EGIB reflects the employee-level manifestation through the generation and implementation of environmentally oriented innovations. Accordingly, GDC may serve as a mechanism linking GDO with EGIB.

Although research on digital transformation, green innovation, green behavior, RBV, and dynamic capabilities continues to expand, the mechanism connecting an environmentally oriented digital orientation with employee green innovation behavior remains insufficiently understood (Dogbe & Marwa, 2024). Previous studies have frequently treated digitalization as a technological resource, green innovation as an organizational outcome, or green behavior as an individual response (Li et al., 2024). Consequently, the relationship among GDO, GDC, and EGIB has received limited examination within an integrated framework. Furthermore, empirical evidence concerning this mechanism across manufacturing firms in Indonesia and Singapore remains limited. It therefore remains unclear whether GDO directly stimulates employee innovation behavior or whether its influence primarily emerges when firms successfully develop environmentally oriented digital capabilities. To address this gap, the study proposes four research questions: RQ1: Does GDO influence EGIB among manufacturing companies in Indonesia and Singapore? RQ2: Does GDO influence GDC?

RQ3: Does GDC influence EGIB? RQ4: Does GDC mediate the relationship between GDO and EGIB?

Based on these gaps, this study examines GDO as a driver of EGIB, with GDC positioned as a mediating mechanism among manufacturing firms in Indonesia and Singapore. The proposed model addresses the theoretical issue of how a firm's strategic green digital orientation can be translated into organizational capability and subsequently into employee-level green innovation behavior. By integrating RBV and DCV within a cross-country Indonesia–Singapore manufacturing context, the study seeks to extend the emerging literature on green digital transformation while providing practical insight into how manufacturing firms can convert digital investments into organizational capabilities and tangible environmental innovation.

2. LITERATURE REVIEW

Theoretical Perspective

This study draws on the Resource-Based View (RBV) and Dynamic Capability View (DCV) to explain the relationships among GDO, GDC, and EGIB. RBV considers internal resources and capabilities as foundations for value creation and competitive advantage. Within this perspective, GDO represents the strategic orientation through which firms direct digital resources toward environmental objectives, while GDC reflects the ability to integrate and utilize these resources to generate environmental value. The resulting capability can subsequently support employees in developing EGIB. DCV complements RBV by emphasizing the ability of firms to adapt and reconfigure resources in response to technological changes and environmental pressures. GDO provides strategic direction toward green digital opportunities, while GDC enables firms to translate this direction into capabilities that can be applied in practice. Thus, RBV explains the resource foundation, whereas DCV explains the process through which resources are developed and reconfigured, positioning GDC as a theoretical mechanism linking GDO and EGIB.

GDO and EGIB

GDO reflects how firms position digital technologies as instruments for achieving environmental objectives (Hein et al., 2026). In manufacturing firms, this orientation may be reflected in the use of technology to control energy and material consumption, improve process efficiency, and develop alternative approaches to reducing environmental impacts (Halbusi et al., 2024). When environmental considerations are embedded within the firm's digital agenda, employees gain a stronger basis for developing work practices that extend beyond task completion toward environmental improvement. Such conditions can create greater opportunities for EGIB to emerge. Employees operating within an environment characterized by a clear sustainability-oriented digital direction may be more inclined to explore ideas, propose changes, and experiment with environmentally responsible work practices. Accordingly, GDO may represent an important organizational condition for encouraging green innovation behavior at the individual level (Hussain et al., 2026).

H1: GDO has a positive effect on EGIB.

GDO and GDC

Directing digital technologies toward environmental objectives requires appropriate capabilities to translate this orientation into organizational practice (Zhang & Liu, 2024). Firms that incorporate sustainability into their digital agenda are likely to face greater demands to develop capabilities for selecting, integrating, and utilizing technologies relevant to environmental challenges. This process can strengthen GDC as an organizational capability supporting the application of digitalization to environmental objectives. GDO also helps firms establish priorities concerning the digital knowledge and competencies that need to be developed (Bindeeba et al., 2025). The clearer the connection between the digital agenda and environmental objectives, the stronger the organizational impetus to develop capabilities that enable technology to address environmental challenges (Dogbe & Marwa, 2024). Therefore, firms with stronger GDO are expected to possess stronger GDC.

H2: GDO has a positive effect on GDC.

GDC and EGIB

GDC provides firms and employees with the capacity to use digital technologies to understand and respond to environmental challenges (Zhang & Liu, 2024). This capability extends beyond basic technology use and involves connecting digital technologies, information, and environmental needs within work processes (Liu et al., 2025). In manufacturing, such capability can help employees identify sources of waste, evaluate production processes, and develop more efficient and environmentally responsible alternatives. Employees with access to digital capabilities that are relevant to sustainability may find it easier to transform digital information and technologies into innovative actions. They can generate new ideas, communicate alternatives to colleagues, and introduce changes into existing work processes (Zhang & Liu, 2024). Therefore, stronger GDC is expected to enhance employees' tendency to demonstrate EGIB.

H3: GDC has a positive effect on EGIB

Mediating Role of GDC

The relationship between GDO and EGIB may operate through the development of organizational capabilities (Zhang & Liu, 2024). A firm's green digital orientation establishes the desired direction, but this direction requires appropriate capabilities to be implemented effectively (Huang et al., 2026). GDC serves as a connecting mechanism by enabling firms to transform their orientation into the ability to use technology, process information, and develop environmentally relevant solutions (Xu et al., 2024). When GDO encourages the development of GDC, employees gain stronger capabilities to utilize digital technologies in generating green innovations. Consequently, the influence of GDO on EGIB may not arise solely from organizational direction but also through the digital capabilities developed from that orientation. GDC therefore represents a mechanism through which green digital orientation can be translated into employee green innovation behavior.

H4: GDC positively mediates the relationship between GDO and EGIB.

3. PROPOSED METHOD

Research Design

This study adopts a quantitative approach with an explanatory research design to examine the relationships among GDO, GDC, and EGIB. Covariance-Based Structural Equation Modeling (CB-SEM) is employed to assess the effect of GDO on EGIB and the mediating role of GDC. Data were collected through a cross-sectional survey during a single research period.

Research Context and Population

The research focuses on manufacturing firms in Indonesia and Singapore. The manufacturing sector was selected because its activities are closely associated with digital technologies, resource utilization, production processes, and environmental concerns. Respondents were employees working in production, operations, technology, sustainability, or managerial functions who had been employed for at least six months and were familiar with digital and environmental practices within their organizations.

Sampling and Sample Size

Respondents were selected using purposive sampling based on predetermined criteria. The sample size was determined using G*Power with a 5% significance level and 80% statistical power. Data were collected through an online survey during 2024–2025 while maintaining respondent anonymity and research ethics. Following the screening process, 223 respondents met the study criteria and were included in the analysis (Kang, 2021).

Measurement Instrument

Data were collected using a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. The measurement items were adapted from previous studies and contextualized to the manufacturing sector. GDO measures the firm's orientation toward directing digital technologies to support environmental objectives. GDC reflects the ability to utilize digital technologies, knowledge, and digital resources to address environmental challenges. EGIB represents employee behavior in generating, developing, and implementing innovative ideas that contribute to environmental improvement.

Common Method Bias

Common method bias was assessed using Harman's single-factor test through SPSS. The largest single factor accounted for 35% of the variance, remaining below the 50% threshold. This result indicates that common method bias does not represent a substantial concern in the study.

Data Collection

The questionnaire was distributed online and/or offline to respondents meeting the established criteria. Before completing the questionnaire, respondents received information regarding the research objectives, data confidentiality, voluntary participation, and informed consent. Screening questions were included to confirm respondent eligibility. After assessing data completeness and suitability, the eligible observations were retained for analysis.

Table 1. Draft Questionnaire

Variable	Code	Indicator	Measurement Item
Green Digital Orientation (GDO) (Xu et al., 2024)	GDO1	Digital technology for environmental objectives	Our company directs the use of digital technologies toward achieving environmental objectives.
	GDO2	Digital sustainability priority	Environmental sustainability objectives are considered a priority in our company's digital agenda.
	GDO3	Digital environmental opportunity	Our company actively seeks opportunities to use digital technologies to address environmental challenges.
	GDO4	Sustainability-oriented digital innovation	Our company encourages the use of digital technologies to develop environmentally friendly solutions.
	GDO5	Integration of digital and environmental goals	Our company's digital strategy is integrated with its environmental sustainability objectives.
Green Digital Capability (GDC) (Xu et al., 2024)	GDC1	Digital environmental information capability	Our company is capable of using digital technologies to obtain information about environmental issues.
	GDC2	Digital environmental analysis capability	Our company is capable of using digital technologies to analyze information related to environmental issues.
	GDC3	Digital green knowledge integration	Our company is capable of integrating digital knowledge with environmental knowledge.

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	GDC4	Digital green solution capability	Our company is capable of using digital technologies to develop solutions to environmental problems.
	GDC5	Digital green innovation capability	Our company is capable of using digital technologies to develop more environmentally friendly products, processes, or working methods.
Employee Green Innovation Behavior (EGIB) (Piwowar-Sulej et al., 2025)	EGIB1	Green idea exploration	I search for new technologies, processes, techniques, or product ideas that can contribute to environmental improvement.
	EGIB2	Green idea generation	I generate new ideas to improve environmental performance in my work.
	EGIB3	Green idea promotion	I promote environmentally friendly ideas and encourage my colleagues to support them.
	EGIB4	Green idea support	I seek support from others to implement new environmentally friendly ideas.
	EGIB5	Green idea implementation	I make efforts to transform environmentally friendly ideas into practical applications in my work.
	EGIB6	Green innovation implementation	I introduce new and more environmentally friendly ways of performing my work.

Data Analysis

The data were analyzed using CB-SEM with SmartPLS 4. The measurement model was assessed through confirmatory factor analysis, including factor loadings, reliability, convergent validity, and discriminant validity. The structural model was evaluated using χ^2/df, CFI, TLI, RMSEA, and SRMR. Hypotheses were assessed using path coefficients, critical ratios, and p-values, while the mediating effect of GDC was examined through indirect effects using bootstrapping (Dash & Paul, 2021).

4. RESULTS AND DISCUSSION

Profile of Respondents

The study involved 223 employees from the manufacturing sector across Indonesia and Singapore. The respondents consisted of employees from both countries, with Indonesia representing the slightly larger share. Male respondents constituted the majority, while female respondents represented a smaller proportion. The largest age group was 25–34 years, followed by respondents aged 35–44 years, those aged 45 years and above, and respondents below 25 years.

In terms of education, most respondents held a bachelor's degree, while the remainder had completed senior secondary or diploma-level education. Regarding work experience, employees with more than six years of tenure represented the largest group, followed by those with three to six years and those with six months to three years. By organizational position, staff and employees formed the largest group, followed by supervisors and managers. This composition provides representation from employees who are directly involved in organizational and operational activities relevant to digital and environmental practices.

Convergent Validity

Convergent validity in CB-SEM was assessed using standardized factor loadings. Values above the minimum acceptable level indicate that indicators contribute adequately to their respective constructs, while higher loadings reflect stronger representation of the underlying construct. The results show that the GDC indicators recorded loadings ranging from 0.570 to 0.830, GDO indicators ranged from 0.686 to 0.727, and EGIB indicators ranged from 0.675 to 0.800. Overall, the indicators met the minimum requirement for convergent validity and were therefore retained in the measurement model.

Table 2. Convergent Validity and Standardized Factor Loadings

Construct	Indicator	Standardized Factor Loading
GDC	GDC1	0,738
	GDC2	0,651
	GDC3	0,570
	GDC4	0,830
	GDC5	0,783
GDO	GDO1	0,718
	GDO2	0,690
	GDO3	0,686
	GDO4	0,727
EGIB	EGIB1	0,710
	EGIB2	0,756
	EGIB3	0,675
	EGIB4	0,679
	EGIB5	0,800
	EGIB6	0,789

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Construct Reliability

Reliability was assessed using Cronbach's Alpha and Composite Reliability (CR), with values of ≥ 0.70 indicating adequate construct reliability. Meanwhile, an AVE value of ≥ 0.50 indicates satisfactory convergent validity. The results show that EGIB achieved a Cronbach's Alpha of 0.874, CR of 0.877, and AVE of 0.542. GDC recorded Cronbach's Alpha of 0.840, CR of 0.839, and AVE of 0.519. GDO obtained Cronbach's Alpha of 0.798, CR of 0.798, and AVE of 0.598. Therefore, all constructs satisfy the required criteria for reliability and convergent validity.

Table 3. Reliability Test

	Cronbach's alpha (standardized)	Cronbach's alpha (unstandardized)	Composite reliability (rho_c)	Average variance extracted (AVE)
EGIB	0,874	0,874	0,877	0,542
GDC	0,840	0,839	0,839	0,519
GDO	0,798	0,796	0,798	0,598

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Goodness of Fit

Goodness-of-fit evaluation in CB-SEM assesses the extent to which the empirical model corresponds to the observed data. The results show that SRMR, CFI, and PGFI meet the specified fit criteria. Meanwhile, χ^2/df, GFI, NFI, and TLI fall within the marginal category, whereas RMSEA, AGFI, and the p-value do not meet the commonly applied criteria. Overall, although several indices do not reach their ideal thresholds, the model demonstrates an acceptable marginal level of fit based on the combined evidence from the fit indices.

Table 4. Goodness of-Fit

Index	Result	General Criteria	Interpretation
Chi-square	269,241	Semakin kecil	Not Fit
p-value	0,000	> 0,05	Does Not Meet the Criteria
χ^2/df	3,095	< 3,00	Marginal
RMSEA	0,097	< 0,08	Poor Fit
SRMR	0,056	< 0,08	Fit
GFI	0,865	≥ 0,90	Marginal
AGFI	0,814	≥ 0,90	Poor
NFI	0,867	≥ 0,90	Marginal
TLI	0,886	≥ 0,90	Marginal
CFI	0,905	≥ 0,90	Fit
PGFI	0,627	> 0,50	Fit

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Normality

Normality was assessed using skewness and excess kurtosis. The data are considered to satisfy the normality assumption when the p-value exceeds 0.05. The results indicate that the skewness test produced a p-value of 0.088, while the excess kurtosis test produced a p-value of 0.291. Since both values exceed 0.05, the data satisfy the normality assumption.

Table 5. Normality

	Test-Statistic	P value
Skewness	730,321	0,088
Excess kurtosis	1,057	0,291

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Hypothesis Testing

Hypothesis testing was conducted using a critical ratio of ≥ 1.96 and a p-value of ≤ 0.05 as the significance criteria at the 5% level. The results indicate that GDC has a positive and significant effect on EGIB, whereas GDO does not have a significant direct effect on EGIB. Furthermore, GDO has a positive and significant effect on GDC. The indirect effect of GDO on EGIB through GDC is also significant, confirming the mediating role of GDC in the relationship.

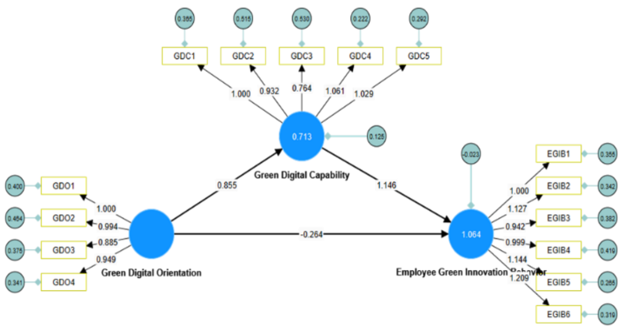

Figure 1. Phat Analysis

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Table 6. Hypothesis

Hypothesis	Original sample (O)	P values
GDC -> EGIB	1,146	0,000
GDO-> EGIB	-0,264	0,211
GDO -> GDC	0,855	0,000
GDO -> GDC -> EGIB	0,980	0,000

Source: Primary data, collected by the researchers in 2026 and analyzed using CB-SEM.

Discussion

GDC and EGIB

The findings demonstrate that GDC has a positive and significant effect on EGIB. This result indicates that the firm's ability to integrate digital technology with environmental requirements plays an important role in shaping employee innovation behavior. Within manufacturing firms, GDC enables employees to utilize technology, information, and data to identify problems in production processes associated with resource consumption and environmental impacts.

The availability of GDC allows employees to move beyond simply operating technology toward using it as a means of identifying new alternatives (Wu et al., 2026). Information generated through digital systems can help employees detect waste, process inefficiencies, excessive resource use, and opportunities for waste reduction. These conditions can stimulate new ideas that are subsequently developed and implemented in the workplace. Thus, GDC extends beyond technical competence and encompasses the ability to employ technology to generate improvements with environmental value.

This capability becomes particularly important in manufacturing environments because green innovation often originates from problems encountered in everyday operations. Employees who understand how technology can be used to interpret production conditions are better positioned to identify alternative solutions. GDC therefore creates conditions that enable employees to connect environmental challenges with digital solutions, ultimately strengthening

EGIB through the generation, development, and implementation of environmentally oriented ideas (Faidah, 2025).

The findings further indicate that GDC development should proceed alongside efforts to strengthen EGIB. Firms should not merely provide digital technologies but also ensure that employees possess the capabilities required to apply those technologies to environmental challenges (Bindeeba et al., 2025). The greater the employees' ability to use technology to understand and resolve environmental problems, the greater the potential for EGIB to emerge.

GDO and EGIB

The findings indicate that GDO does not have a significant direct effect on EGIB. This result suggests that a firm's orientation toward directing digitalization toward environmental objectives does not automatically generate green innovation behavior among employees. GDO can establish the importance of integrating digitalization and sustainability, but such direction may not immediately translate into innovative action.

Within manufacturing firms, GDO may be reflected in organizational priorities concerning the use of technology to improve resource efficiency, reduce waste, and enhance production processes. However, employees still require the ability to understand how these technologies can be applied to environmental challenges. When such capabilities have not yet been developed, GDO may remain at the organizational orientation level without producing meaningful changes in employee behavior.

The findings reveal a potential gap between orientation and implementation. GDO indicates the direction the firm seeks to pursue, whereas EGIB requires practical capabilities to translate that direction into workplace activities (Xu et al., 2024). Employees may understand that their organization encourages the use of technology for environmental purposes, but this awareness alone may not be sufficient to generate new ideas without the ability to use technology, process information, and identify improvement opportunities.

Therefore, the absence of a significant direct effect does not imply that GDO is irrelevant to EGIB. Rather, the finding suggests that the relationship may require an intermediate mechanism before it can materialize at the employee level. In this model, that mechanism is represented by GDC, which connects GDO with EGIB (Dogbe & Marwa, 2024).

GDO and GDC

The results demonstrate that GDO has a positive and significant effect on GDC. This finding indicates that stronger organizational direction toward using digitalization for environmental objectives is associated with greater capability to utilize digital technology in addressing sustainability requirements.

GDO provides firms with direction in determining the technologies, knowledge, and competencies that are relevant to environmental objectives. When digitalization is positioned within a sustainability framework, firms have stronger incentives to develop capabilities that allow technology to be used more purposefully. This process may involve enhanced use of data, development of digital systems, strengthening of employee competencies, and integration of technology into production processes.

In manufacturing environments, these needs may arise across various production activities. The use of technology to monitor energy consumption, control material use, identify waste, and oversee production processes requires capabilities that extend beyond technical operation (Feng et al., 2022). Firms also need the ability to connect technological applications with environmental objectives. GDO provides the strategic direction for developing these capabilities, allowing GDC to evolve in accordance with organizational needs.

The relationship between GDO and GDC also suggests that green digital capability does not develop independently of organizational strategy. When firms possess a clear orientation toward sustainable digitalization, capability development becomes more focused. Conversely, without a clear orientation, existing digital capabilities may be directed primarily toward general operational objectives rather than environmental outcomes (Feroz et al., 2021).

Mediating Role of GDC

The findings demonstrate that GDC mediates the relationship between GDO and EGIB. This result is important because it suggests that the influence of GDO on EGIB is better understood through capability development rather than as a direct relationship.

GDO establishes the direction for using digital technology to support environmental objectives, whereas GDC enables this direction to be translated into capabilities that can be applied within organizational activities. When GDC is sufficiently developed, employees possess stronger capacity to use technology, interpret information, identify problems, and develop environmentally oriented solutions (Nambisan et al., 2017). These conditions subsequently create greater opportunities for EGIB.

The findings therefore position GDO as the initiating organizational orientation, GDC as the connecting capability, and EGIB as the behavioral outcome. GDO establishes a sustainability-oriented digital direction, but this direction requires appropriate capabilities before it can influence employee behavior. GDC becomes critical because it transforms a strategic orientation into capabilities that can be applied in daily work.

Within manufacturing, this mechanism can be observed when firms direct technology toward reducing resource waste. The strategic direction is then translated through employee capability development, including the ability to use digital systems, interpret production data, identify sources of inefficiency, and develop improvement alternatives (Warner & Wäger, 2019). Once these capabilities are available, employees have a stronger foundation for generating and implementing green ideas. EGIB can therefore emerge from a process initiated by GDO and enabled through GDC.

The mediating role of GDC also explains why GDO does not demonstrate a significant direct effect on EGIB. Organizational orientation alone may be insufficient to produce innovative behavior without implementation capabilities. A firm may possess a strong green digital agenda, but its effect on EGIB depends on the extent to which that agenda is converted into capabilities that employees can actually use (Feroz et al., 2021). The findings imply that manufacturing firms need to develop GDC as an integral component of implementing GDO. Strengthening digital capabilities, utilizing data, developing technological competence, and enhancing employees' ability to connect technology with environmental challenges can reinforce this process. As GDC develops, GDO has greater potential to produce tangible EGIB.

5. CONCLUSIONS

This study demonstrates that GDC plays an important role in promoting EGIB among manufacturing firms in Indonesia and Singapore. GDC provides the capability that enables employees to utilize digital technologies to develop environmentally oriented innovations. GDO does not have a direct effect on EGIB but positively influences GDC, suggesting that green digital orientation needs to be translated into organizational capability before it can generate behavioral outcomes. GDC also significantly mediates the relationship between GDO and EGIB. Thus, green digital transformation in Southeast Asian manufacturing requires alignment among digital orientation, capability development, and employee innovation. This study has limitations related to its cross-sectional design, which does not capture changes in the relationships among GDO, GDC, and EGIB over time, as well as its reliance on employee perceptions, which may introduce response bias. The focus on manufacturing firms in Indonesia and Singapore also limits the generalizability of the findings. Future research could employ longitudinal designs, combine perceptual data with objective firm-level measures, and extend the research context to other Southeast Asian manufacturing countries. Future studies may also examine additional organizational and technological factors that could strengthen the relationships among GDO, GDC, and EGIB.

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