The Formation Mechanism of Corporate Sustainable Innovation Capability: An Integrated Theoretical Framework Based on Dynamic Capabilities and ESG Orientation

1st Chanin Wangwichai
Walailak University Nakhon Si Thammarat,Thailand
ChaninWangwichai@outlook.com

2nd Pichit Thongthai
Mahasarakham University Mahasarakham,Thailand
PichitThongthai@outlook.com

3rd Narong Kitpipatkorn
Sukhothai Thammathirat Open University Bangkok,Thailand
NarongKitpipatkorn@outlook.com

***Abstract*—Under the background of carbon neutrality and s ustainable development, firms need to transform ESG orientati on into substantive sustainable innovation capability. Drawing on institutional theory, stakeholder theory, and dynamic capab ilities theory, this study develops an integrated framework linki ng ESG orientation, dynamic capability microfoundations, and sustainable innovation capability. It argues that ESG orientati on does not automatically generate sustainable innovation outc omes; rather, its effect depends on firms'sensing,seizing,and re configuring capabilities. Institutional pressure is further propo sed as a boundary condition influencing this transformation pr ocess. The study provides a theoretical explanation for how fir ms can move beyond symbolic ESG disclosure and build sustai nable product and process innovation capabilities, offering a fo undation for future empirical research using panel data or stru ctural equation modeling.**

Keywords—Sustainable Innovation Capability, ESG Orientat ion, Dynamic Capabilities, Institutional Pressure, Design Innovat ion

I. INTRODUCTION

Sustainability has become one of the key factors that hav e driven business innovation and altered the nature of compet itive advantage due to the heightened level of world climate change and resource scarcity [1]. The increased focus of the global market on the principles of Environmental, Social, an d Governance (ESG) causes the companies to experience gre ater institutional pressure and stakeholder demands [2]. As p art of such a paradigm shift, innovation is not regarded as tec hnological development any longer, but as sustainable innov ation process that entails the enhancement of resource efficie ncy, resource swapping, and optimal ecosystem [3]. Nonethe less, due to the nature of the external environment and the hi gh cost of switching, many organizations get caught up in the greenwashing trap whereby they put in a lot more effort on s uperficial disclosure rather than doing what is actually ecolo gically sound in their operations. Thus, the problem of conve rting the external ESG orientation into an effective internal s ustainable innovation capacity is a fundamental challenge in scientific theory and practice.

The review of the available literature proves that there is a significant amount of research dedicated to the determinant s of sustainable innovation. The scholars based on institution al theory also investigate how government regulations, mark et standards, and competition among peers can force compan ies to innovate their environmental performance [4]. There ar e additional studies performed in the context of the resource-based viewpoint which investigates the catalyzing roles playe d by the internal factors including organizational slack and e nvironmental awareness of executives [5]. However, there re main significant flaws. To begin with, much of the literature offers a fixed picture of the resource inputs and the innovatio n outcomes disregarding the dynamism of the evolutionary p rocess of the perception of opportunities, resources combinat ion, and restructuring of business processes in the digitalized and uncertain environment [6]. Third, ESG may be seen as a dependent variable or an exogenous measure or at most a stra tegic direction which can alter organizational capability radic ally. Finally, the boundary conditions particularly the interact ion between institutional pressure and internal strategic orien tation have not been tested using mechanistic methods.

The present study is expected to fill up these gaps by inte grating theoretical conceptualization of ESG Orientation, Dy namic Capabilities and Sustainable Innovation Capability. It clarifies how the ESG orientation of the three micro foundati ons of dynamic capabilities, namely sensing, seizing and rec onfiguring and their role in the development of sustainable pr oduct and process innovations can be activated. The paper al so examines the external institutional pressure as the boundar y condition that sets the direction of EEG orientation towards internal organizational capacity. The study offers theoretical support and research design that would be used in empirical r esearch on sustainable innovation capability in a manufacturi ng company by explaining this mechanism.

II. LITERATURE REVIEW

A. The Evolution of Sustainable Innovation and Research Limitations

Sustainable innovation has become a changing concept over time to signify not just the end of the pipe treatment but rather as part of the overall lifecycle. According to Varadarajan, sustainable innovation can be described as an innovation in which a company creates new products, services, or even business models which significantly lower the negative effect of its activities on the environment [3]. It does not only decrease the use of renewable and non-

Corresponding Author: Narong Kitpipatkorn,Sukhothai Thammathirat Open University 9/9 Mu 9,Chaengwattana Road Bangpood Subdistrict, Pak kret District,Bangkok,Thailand,11120,NarongKitpipatkorn@outlook.com

renewable resources but substitutes the resources and recovers the value. Studies have shown that this type of sustainable innovation enables organizations to gain legitimacy, reputation, and better long-term financial performance [7]. Nevertheless, existing literature has paid too much attention to what they refer to as outcome orientation (e.g., financial and environmental performance results) and neglected process orientation (i.e., how to develop the capability to innovate in the organization). This paradigm offers the companies sufficient reasons to innovate but it lacks the practical means to do so.

B. Theoretical Tools: Dynamic Capabilities and ESG Orientation

In this paper, dynamic capability theory and stakeholder t heory are used as the core concepts of analysis in order to op en the black box of capability building[8]. Dynamic capabilit ies are described by Teece as the capacity of an organization to combine, create and restructure its internal and external ca pabilities in response to an evolving environment, which is d efined by him as three microfoundations: sensing (the detecti on of changes and opportunities in the environment), seizing (activation of resources to capitalize on opportunities) and re configuring (changing and renewing assets continuously). Th e sustainability context means that companies should have th ese higher-level capabilities in order to achieve a balance bet ween conventional economic factors and environmental dem ands [9].

On the other hand, the idea of ESG orientation can also b e considered as a new form of stakeholder theory, and it impl ies that a company is strategically focused on and invests in e nvironmental, social and governance matters [10]. It is not m erely a precautionary step to ensure compliance, but an activ e step to address the interests of various stakeholders and obt ain significant innovation resources. ESG orientation and dy namic capabilities are useful in explaining how the external s ocial responsibilities are integrated into the fundamental busi ness logic of firms.

C. Identification of Research Gaps

Although recent research has started to examine the effec ts of digital transformation on green dynamic capabilities [6] or the direct correlation between ESG performance and green innovation [11], the idea of ESG orientation is not often take n as a primary strategic factor. The causal mechanism - the u nderlying mechanism of the operation of ESG orientation acr oss the whole dynamic capability chain of sensing-seizing-re configuring to eventually gain the form of sustainable innova tion capability (product and process innovation)- remains un verified. Besides, the sensitivity and heterogeneity of this me chanism of transformation have also not been explored thoro ughly with regard to the boundary conditions of institutional pressures (coercive, normative and mimetic). Hence, the curr ent paper will pay attention to the way the development of th e ESG orientation will create the dynamic capability microfo undations and result in the formation of the sustainable innov ation capability under different institutional pressure conditio ns.

III. Theoretical Framework and Propositions

Building upon the literature review, this study integrates institutional theory, stakeholder theory, and dynamic capabilities theory to construct the conceptual model illustrated in Fig.1. The model posits that ESG orientation, as a strategic intent, cannot automatically translate into innovation outcomes; it must be realized by activating internal dynamic capability microfoundations, a process contingently influenced by external institutional pressures.

Figure 1. The Integrated Theoretical Framework of Sustainable Innovation Capability Formation

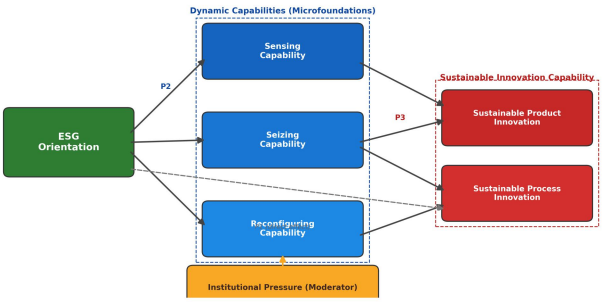

Fig. 1. The Integrated Theoretical Framework of Sustainable Innovation Capability Formation

A. ESG Orientation and Sustainable Innovation Capability

From a stakeholder theory perspective, firms with high ESG orientation can better establish trust with governments, consumers, and investors, thereby accessing richer innovation resources and knowledge spillovers [10]. For product innovation, ESG orientation compels firms to consider the ecological impact of the entire product life cycle, promoting green material substitution and low-carbon design. For process innovation, it forces firms to optimize production processes and reduce energy consumption and emissions [3]. Therefore, we propose:

- P1: ESG orientation significantly and positively impacts corporate sustainable innovation capability.
- P1a: ESG orientation positively promotes sustainable product innovation capability.
- P1b: ESG orientation positively promotes sustainable process innovation capability.

B. ESG Orientation and Dynamic Capability Microfoundations

The construction of dynamic capabilities relies on specifi c strategic orientations and resource commitments [8]. First, a strong ESG orientation prompts firms to establish more acu te environmental scanning mechanisms, enhancing sensing c apability. Second, upon sensing sustainable opportunities, ES G orientation guides firms to break down departmental silos and mobilize cross-boundary resources, thereby improving s eizing capability. Finally, to ensure sustained green competiti ve advantage, ESG orientation drives firms to phase out high ly polluting capacities and restructure supply chain ecosyste ms, achieving an upgrade in reconfiguring capability [6]. The refore, we propose:

- P2: ESG orientation positively promotes the develop ment of dynamic capability microfoundations.
- P2a: ESG orientation positively impacts sensing capa bility.
- P2b: ESG orientation positively impacts seizing capa bility.
- P2c: ESG orientation positively impacts reconfigurin g capability.

C. The Mediating Role of Dynamic Capabilities

Dynamic capabilities act as the core "bridge" between strategic intent and performance outcomes. The directional guidance and resource guarantees provided by ESG orientation must pass through the relay process of "sensing-seizing-reconfiguring" to overcome organizational inertia and path dependence in green transformation [9]. Therefore, we propose:

- P3: The microfoundations of dynamic capabilities mediate the relationship between ESG orientation and sustainable innovation capability.

D. The Moderating Role of Institutional Pressure

Institutional theory suggests that strategic choices are deeply embedded in institutional environments [4]. When facing high regulatory pressures (e.g., stringent environmental laws) and normative pressures (e.g., public opinion), the costs of non-compliance and reputation risks escalate sharply. In such contexts, the urgency to translate ESG orientation into dynamic capabilities is stronger, and management allocates more attention and resources to environmental scanning, technology acquisition, and process transformation [12]. Conversely, in weak institutional environments, ESG behavior may remain symbolic. Therefore, we propose:

- P4: External institutional pressure positively moderates the transformation of ESG orientation into dynamic capability microfoundations.

IV. METHODOLOGY

A. Research Logic

The paper has been written mostly in the form of theoretical development and framework-building paper. Additional measures towards enhancing applicability and testability of the proposed framework are presenting the operational research design of the future empirical validation so that it can be more applicable and testable. It is anticipated that the proposed design will contribute to explaining what can be done to measure and evaluate the relationships between ESG orientation, dynamic capability microfoundations, institutional pressure, and sustainable innovation capability in repeatable manners.

B. Potential Sample and Data Sources

Due to the fact that manufacturing companies are usually subjected to higher environmental restrictions and have more apparent sustainable innovations, this future empirical study could choose the given manufacturing companies as a sample to use in the research. A multi-year panel dataset comprises ESG ratings, company financials, patent data and annual report textual data. Third party ESG rating databases, official corporate annual reports, patent databases and financial databases can be possible data sources. The report of sampling criteria, exclusion rules of firms, how to deal with missing values, classification of industries, length of the observation, and time of extracting data should be explicitly stated in future studies to enable reproducibility.

C. Variable Operationalization

The measure of ESG orientation can be done via third party ESG ratings, ESG disclosure or some combination of indices, which are applied to indicate how much the companies are dedicated to environmental, social, and governance aspects [13]. The concept of sustainable innovation capability may also be seen as consisting of two dimensions: product-based sustainable innovation and process-based sustainable innovation. The number of patent applications related to green products, or green product development indicators is used to measure the first dimension, while the second dimension is measured by the number of process improvement or energy saving technology patents, or cleaner production indicators.

Dynamic capability microfoundations may be implemented in three ways which are sensing, seizing, and reconfiguration. Sensing capabilities refer to how organizations can sense opportunities that are present in the market, regulatory, and technologically sustainable. Seizing capability means its capacity to reallocate resources, forge alliances, and put resources into sustainable innovation opportunities. Reconfiguration capability is the power of changing organizational practices, restructuring the production process, and restoring the resource configurations. The dimensions can be assessed by validated survey scales or text analysis of annual reports, or qualitative and quantitative indicators [14][15].

Institutional pressure takes three forms namely regulatory pressure, normative pressure and industry-level environmental expectations. Some indicators can be the level of environmental regulation in the region, prevalence of environmental penalties in the industry, ESG disclosure standards, and stakeholder interest. Firm size, firm age, profitability, leverage, ownership type, R&D intensity, and industry and year effects are control variables.

D. Suggested Empirical Strategy

To test it empirically in the future, the panel regression models, structural equation modeling, and mediation or moderation analysis of the available data can be employed [16]. If the adoption of panel data is made, controlling the unobserved heterogeneity, both by incorporating firm and year fixed effects into the model, will be possible. The robustness is tested through substituting critical variables, lagged independent variables, and deleting unique industries and other alternative model specifications. When surveys are used as a source of data, reliability, validity, common-method bias, and discriminant validity must be considered. Full regression tables, standard errors, confidence intervals, sample size and model diagnostics should be reported by the empirical model to promote transparency and reproducibility.

V. THEORETICAL MECHANISM ANALYSIS AND ILLUSTRATIVE VISUALIZATION

Note: The figures in this section are used as illustrative visualizations of the proposed analytical framework. They are intended to clarify the expected theoretical relationships and possible empirical testing procedures. Future empirical studies should report complete data sources, sample selection procedures, model specifications, regression tables, standard errors, confidence intervals, and robustness tests before treating these relationships as validated statistical findings.

A. Analytical Logic of the Proposed Framework

This section further explains the theoretical mechanism of the proposed framework and uses illustrative visualizations to show how the relationships among ESG orientation, dynamic capability microfoundations, institutional pressure, and sustainable innovation capability may be examined in future empirical research. The figures in this section are intended to demonstrate the analytical logic and potential empirical testing structure rather than to serve as final statistical evidence.

ESG orientation can guide firms to incorporate environmental and social considerations into strategic decision-making, product development, and process improvement. Firms with stronger ESG orientation are more likely to pay attention to resource efficiency, low-carbon production, green product design, and stakeholder expectations. Therefore, ESG orientation provides a strategic basis for sustainable innovation capability. However, ESG orientation alone does not automatically generate innovation outcomes. Its influence depends on whether firms can transform external sustainability expectations into internal organizational capabilities.

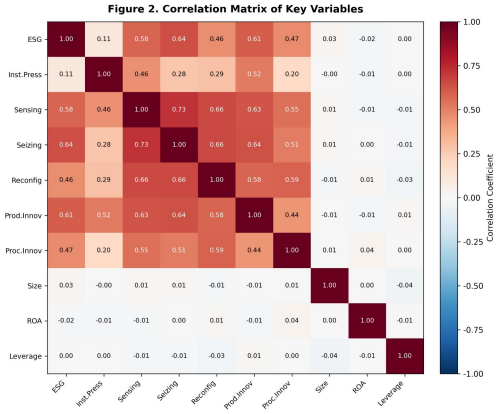

Fig. 2. Illustrative correlation structure among key constructs

Fig.2 presents an illustrative correlation structure among the key constructs. It demonstrates the expected positive associations between ESG orientation, dynamic capability microfoundations, and sustainable innovation capability. This visualization is used to clarify the theoretical relationships that future empirical studies may test through correlation analysis and multicollinearity diagnostics.

B. *Dynamic Capability Microfoundations as the Transformation Mechanism*

Dynamic capabilities explain how firms transform strategic orientation into concrete innovation actions. Sensing capability helps firms identify sustainability-related opportunities and risks, such as changes in environmental regulation, consumer preferences, and green technology trends. Seizing capability enables firms to allocate resources, invest in green technologies, and build partnerships. Reconfiguring capability allows firms to adjust production systems, organizational routines, and supply-chain structures.

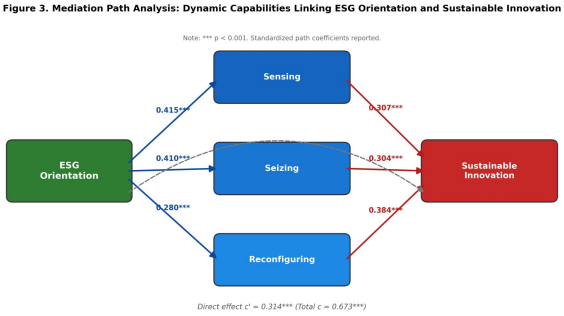

Fig. 3. Illustrative standardized relationship structure of the proposed framework

Through these three microfoundations, ESG orientation can be translated into sustainable product and process innovation capability. Fig.3 provides an illustrative visualization of the potential standardized effects among ESG orientation, dynamic capability microfoundations, and sustainable innovation outcomes. The purpose of this figure is to show the expected direction and relative structure of the proposed relationships. Future empirical studies should verify these relationships using full model specifications, standard errors, confidence intervals, and robustness tests.

C. *Mediating Role of Dynamic Capabilities*

The proposed framework suggests that dynamic capabilit y microfoundations serve as the mediating mechanism betwe en ESG orientation and sustainable innovation capability. ES G orientation first shapes managerial attention and strategic c ommitment; sensing, seizing, and reconfiguring capabilities t hen convert this orientation into opportunity identification, re source mobilization, and organizational transformation; finall y, these capabilities support sustainable product and process i nnovation.

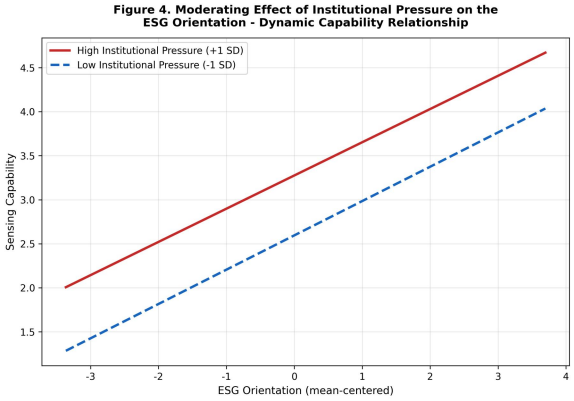

Fig. 4. Conceptual mediation mechanism of dynamic capability microfoundations

Fig.4 illustrates the conceptual mediation mechanism. It shows that ESG orientation may influence sustainable innovation capability both directly and indirectly through dynamic capability microfoundations. This mediation path should be interpreted as a theoretically proposed mechanism rather than conclusive empirical evidence. Future studies can test this mechanism through structural equation modeling, panel mediation models, or Bootstrap-based indirect-effect analysis.

D. *Boundary Role of Institutional Pressure*

Institutional pressure may influence the strength of the relationship between ESG orientation and dynamic capabilities. Under strong regulatory and normative pressure, firms face higher non-compliance costs and stronger stakeholder scrutiny, which may encourage them to convert ESG commitments into substantive capability-building actions. Under weak institutional pressure, firms may be more likely to engage in symbolic ESG disclosure without substantial organizational transformation.

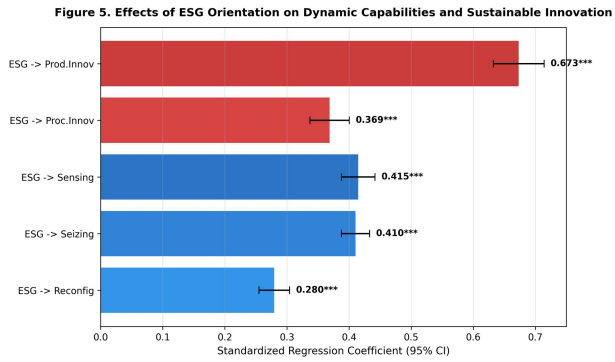

Fig. 5. Illustrative moderating role of institutional pressure

Fig.5 illustrates the boundary role of institutional pressure in the ESG orientation-dynamic capability relationship. The visualization suggests that the transformation from ESG orientation to dynamic capability may be stronger under higher institutional pressure. This figure is used to present the theoretical moderation logic and should be validated in future research through interaction-term models, subgroup analysis, or marginal-effect analysis.

E. *Integrated Mechanism*

Overall, the proposed framework suggests a sequential m echanism: ESG orientation first shapes managerial attention and strategic commitment; dynamic capability microfoundati ons then convert this orientation into opportunity identificati on, resource mobilization, and organizational reconfiguration; finally, these capabilities support sustainable product and pr ocess innovation. Institutional pressure further determines w hether ESG orientation leads to substantive organizational ca pability development or remains at the level of symbolic ES G disclosure. This mechanism provides a theoretical explanat ion for why some firms achieve substantive sustainable inno vation while others remain trapped in superficial ESG practic es.

VI. Discussion

The theoretical framework that is suggested provides a number of ideas about what kind of actions should companies undertake in order to obtain sustainable innovation capabilities.

To begin with, revising an old-fashioned attitude towards ESG being an expense. Conversely, in contrast to the neoclassical economic positions that hold that ESG investments replace the R&D investments [11], this paper suggests that ESG orientation might be used as a strategy before the process/product innovation of sustainability is achieved with support of the internal dynamic capabilities [17]. High ESG performance allows companies to get the best green loans, policy subsidies, and employees that can add value to innovation processes, which is in line with the fact that proactive green policies may provide quantifiable advantages to performance [18].

Then it should be to unlock the black box of the Orientation-Innovative. In this paper, a chain transmission mechanism of sensing-seizing-reconfiguring is conceptualized through the introduction of Teece dynamic capability microfoundations [8]. Innovation of sustainability is not merely the adoption of technologies but also the bravery and ability to overcome organizational inertia and completely transform supply chains and manufacturing processes, which implies that sustainability is now the main driver of innovation [19].

Finally, the development of the non-linear margin of institutional pressure. The institutional pressure cannot play the role of moderation in a linear growth fashion. At lower levels of pressure, ESG behaviors might serve as some form of symbolic management that can be used to counteract popular opinion. There is a possibility that this occurs only when the regulatory and normative pressures are sufficient to ensure that the cost of not complying with them is significantly higher than the benefit of greenwashing and only in such cases will organizations be forced to introduce the concept of ESG principles into the fabric of their organizational dynamic capability restructuring [12].

VII. Conclusion

A. *Research Conclusions*

Based on the principles of sustainable development across the globe and applying such concepts as institutional and dynamic capabilities theories, there is an integrated theoretical framework in this paper that could explain the process of applying ESG orientation to create corporate sustainable innovation capability by explaining it with the help of the microfoundations of dynamic capabilities. The main theoretical findings consist of the following: initially, ESG orientation can be considered as a strategic starting point of sustainable innovation, yet it cannot guarantee the results of innovation; then, sensing, seizing and reconfiguration are the microfoundations of dynamic capabilities which act as the main change mechanism in the connection between ESG orientation and sustainable innovation capability; finally, institutional pressure might become a decisive limiting factor in the issue of whether ESG orientation will bring significant organizational capability growth or remain in the shape of symbolic disclosure.

B. *Theoretical Contributions*

The research will extend the theoretical frontiers of cross-disciplinary design innovation further and promote the status of ESG as a kind of conventional compliance reporting to the level of strategic orientation implying that the social and env ironmental problems management could become the lever of competitive advantage instead of being considered as the cos t [20]. In order to clarify the use of dynamic capabilities in th e context of sustainability, the author explains what dynamic capabilities mean by breaking down the microfoundations of sensing-seizing-reconfiguring, which also has a limitation by the use of the black box approach to dynamic capabilities. M oreover, it illustrates how the internal development of capacit ies and external institutional power are synergistically related.

C. *Practical Implications*

The company should not focus on this overly restricted at titude that considers ESG as a waste of time in PR and instea d see it as an extended solution to the organization. Managers are advised to consciously design dynamic capability microf oundations by implementing the typical processes of environ mental scanning, cross-boundary resources integration and c ore assets restructuring. The politicians are expected to optim ize the mechanisms of ESG evaluation systems and environ ment regulations that will constitute the right institutional pre ssure and limit the scope of the greenwashing practice.

D. Limitations and Future Research

In the present research population, the current study will only consider the subset of the listed Chinese manufacturing companies as its research population; other research populati ons may consist of extending the current population to the se rvice sector or cross-country comparison. The dynamic capa bilities are measured by text-mining that may not be able to c apture the finer details of the tacit capabilities, therefore, futu re research could involve the application of deeper case studi es (i.e., grounded theory) in order to cross-validate. In summ ary, because of the advent of the digital technologies, the furt her research could explore how the artificial intelligence and big data could contribute to the empowerment of the develop ment of the sensing-seizing-reconfiguring, and initiate a new wave of the innovation research of the dual-core driven appr oach that combines digitalization and greening.

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AUTHOR CONTRIBUTIONS

Chanin Wangwichai: Conceptualization, methodology, th eoretical framework development, formal analysis, writing—original draft, and project administration.

Pichit Thongthai: Literature review, methodology refine ment, visualization, and writing—review and editing.

Narong Kitpipatkorn: Supervision, validation of the theor etical argument, critical revision of the manuscript, and writi ng—review and editing. All authors have read and approved the final manuscript.

COMPETING INTERESTS

The authors declare no competing interests.