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RESEARCH ARTICLE

Examining the Impact of Supply Chain Management and Open Innovation on Sustainability Performance in Thailand: The Mediating Role of Organizational Learning Culture

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ABSTRACT

This study examines the impact of supply chain management (SCM) and open innovation (OI) on sustainability performance (SP) in Thailand, emphasizing the mediating role of organizational learning culture (OLC). Utilizing a sample of 400 organizations, data was analyzed using structural equation modelling (SEM) to explore the direct and indirect relationships among the constructs. The findings reveal that SCM significantly enhances both OI and SP. OI, in turn, positively influences SP. Moreover, OLC is identified as a critical mediator, significantly affecting the relationship between SCM and SP. The indirect effects further confirm that OLC strengthens the pathway from SCM to SP through OI. These results underscore the importance of fostering a strong learning culture within organizations to maximize the benefits of SCM and innovation on sustainability outcomes. This study contributes to the existing literature by providing empirical evidence from the Thai context. It offers practical implications for managers seeking to improve sustainability performance through strategic supply chain and innovation practices. Future research could extend these findings across different regions and industries to enhance the generalizability of the results. In conclusion, integrating SCM, OI, and OLC is pivotal for organizations aiming to achieve sustainable development.

INTRODUCTION

In the current business scenario, sustainability is gradually gaining traction as business leaders realize that maintaining sustainability has become part and parcel of corporate strategy due to mounting stakeholders' demands and rigid regulatory environments. Firms experience a higher level of pressure than ever before to integrate sustainability into the inner working fabric of their business so that they can attain long-term sustainability and be environmentally responsible (Srisathan et al., 2020). Incorporating supply chain management (SCM) and open innovation in sustainability performance analysis opens many possibilities for addressing complex issues and significantly boosting results. Such elements can produce more comprehensive results when influenced by a learning culture encouraging openness to change and innovation (Jermsittiparsert et al., 2019). Supply chain management is a multifaceted discipline beyond logistics to incorporate procurement, production, and distribution processes. Efficient possession and management of the supply chain

system is a must in order to achieve production efficiency and cost savings (Liu et al., 2023). Firstly, and most importantly, SCM has since been considered the central component of sustainability. Through resource efficiency, waste reduction, and environmental impact reduction, good SCM policies can significantly help a company's sustainability activities (Carter & Rogers, 2008). An example of this would be the adoption of green supply chain management (GSCM) practices, which include eco-design and green purchasing, both of which have shown advantages in terms of performance on environmental and operational levels (Tantayanubutr & Panjakajornsak, 2017).

Open innovation, manifested by the strategic use of external ideas and partnerships, complements SCM in reinforcing the internal innovation processes. In this way, innovators disregard the classical closed innovation model and benefit from more comprehensive knowledge and know-how (Naruetharadhol et al., 2021). Using open innovation, firms can cooperate with external partners like suppliers, customers and competitors to create sustainable solutions (Phonthanukitithaworn et al., 2023). For example, product and process development cooperation can lead to the most significant progress in sustainability. Nike's sustainable material development through stakeholder collaboration best demonstrates the role of open innovation in enabling sustainability (Sharafuddin et al., 2022). The SCM-open innovation equilibrium is often set in motion by a culture of organizational learning. This culture is separate in the form of shared values and practices that continuously encourage learning and adaptation. It is essential to uphold innovation and sustain the desirable long-term wise thinking. Companies emphasizing learning culture stand out as the best of the lot, and they are prepared to integrate new knowledge and improve processes to gain a competitive edge (Girdwichai et al., 2019). For instance, a firm focusing on the free flow of information and carrying out a learning process can work wonders to cater for sustainability (Rahmanzadeh et al., 2023).

Empirical evidence indicates the substantial role of SCM in sustainability performance. The data has disclosed that green SCM practices reduce environmental and operational costs (Audretsch et al., 2023). Collaboration with suppliers becomes especially important when improving environmental performance (Lee & Roh, 2023). The data presented above confirms the critical role played by the SCM in achieving sustainability goals. Besides this, the contribution of open innovation in sustainable development is also well-established. Suksodand Pongsiri (2019) stated that the open innovation framework allows the creation of sustainable products and processes, which are formed by combining external knowledge. The ability to work with external partners will be brought in to give room for the adoption of best practices and innovative solutions that are highly regarded to reach sustainability. This inclusive way multiplies the spread of information and simultaneously speeds up the practical application of sustainable strategies (Huong et al., 2021). The role of an organizational learning culture, being its channels in the relationship of SCM, open innovation, and sustainability performance, becomes pivotal. In enterprises that have a robust learning culture, the shaking down of the pace is more accessible, and they are better capable of including new information in the operational process (Khan et al., 2021). This responsiveness is at the heart of assuring us that sustainability practices will constantly evolve positively to bring better outcomes. Organizations, where highly competent personnel, learning culture, and knowledge-sharing are adopted, are more likely to sustainably boost their environmental performances (Kimseng et al., 2020).

Sustainability has become essential for all sorts of companies across the globe that are doing business in this current dynamic environment. The unique key driver of such consideration lies in the various parameters, such as regulatory pressure, stakeholders' expectations, and the sustainability of business operations. Many organizations see the value of sustainability; many still need help embedding sustainable processes into their business core (Kuwornu et al., 2023). This challenge highlights a significant problem: getting an insight into how an organization can cheerfully make sustainability performance efficient using different managerial practices and cultural factors. This issue involves a multifaceted assessment of the dynamic relationships among supply chain

management (SCM), open innovation, and organizational learning culture (Khoso et al., 2024). The main goal of this research is to explore the immersive influences of product supply chain management, open innovation, and organizational learning culture on corporate sustainability performance. The paper centres on the quantitative research of ScD's impact on sustainability outcomes through the lens of sustainability, the role of open innovation for sustainable development, and the nonemendation of organizational learning culture on these relations. It is through meeting these objectives that the paper will be expected to deliver a sophisticated interpretation of how these contributions fit and collectively make organizational sustainability possible. Such activities are vital as they demonstrate the ability to develop strategies that provide an adequate environment for generating sustainable practices (Suteerachai et al., 2019).

The significance of this study is multifaceted. Theoretically, it provides the academic community with a dynamic framework for viewing sustainability issues through a blended perspective of SCM, open innovation, and organizational learning culture. Previous research has usually studied each of these components in isolation. Therefore, understanding how their different components affect each other is needed (Liu et al., 2023). This study seeks to bridge this gap by examining connectivity among organizational dimensions, thus providing a broader view of organizational sustainability.

This integrative approach is no longer confined to academia but provides a more substantial basis for building future research in the area (Pakdeechoho & Sukhotu, 2018). Regarding application, this study is crucial for managers and relationship practitioners in influencing their organizations' sustainability success. A research study emphasizes the centrality of incorporating SCM and open innovation within a learning management model. It suggests a framework for implementing this approach to sustainability. Alongside generating these discoveries, managers can establish a learning-based environment that will foster continuous improvements and innovation and culminate into better outcomes for sustainability. To exemplify, partnering externally with other stakeholders can be fruitful and bring in new notions and technologies. A learning culture ensures the organization finds these innovations that apply well in day-to-day activities (Wongwilai & Hotrawaisaya, 2022; Tippayawong et al., 2016).

Furthermore, empirical data given as a proof of concept based on this study makes it into practice. While reviewing official statistics, the research identifies and proposes measures that the practitioners can base their decisions on (Chin et al., 2015). This empirical focus fills the gap between science and practice methods so that the discovered facts are theoretical inquisitiveness and practical applicability. Moreover, the study's findings that environmental management practices in supply chains positively impact sustainability performance by organizations stress the need to embrace green practices within the supply chain (Buranasiri et al., 2024). Notably, this study also influences policy choices a lot. Decision-makers and regulatory authorities can use the research results to develop and showcase the integration of green approaches and policies toward sustainable practices across society. Interconnecting the strategic importance of SCM, high-tech innovation, and corporate organizing learning culture, policymakers can develop recommendations accordingly, stimulating organizations' sustainable activities. These measures may be tax credits and rewards for implementing green supply chain management practices, funding collaborative projects for innovation purposes, and programs to foster and improve continuous organizational and individual learning (Tjahjadi et al., 2020).

The paper is divided into six main sections. The introductory part explains the study's objectives and the significance and context of the issue for the study. The literature review provides a synthesis of the literature, which shows essential fields, concepts, and areas for additional investigation. The Methodology outlines the research design, data collection and analysis in detail. The Empirical Findings comprise the findings obtained by the analysis supported by the relevant data and statistical significance. The conclusion summarizes the results obtained, connecting them with available

literature and theoretical framework and setting out the findings' limitations and prospects for future research. Finally, the Conclusion section concludes, emphasizing the emphases, contributions, and applications.

LITERATURE REVIEW

The advances in sustainability of organizational settings have become a trend in the last few years because of the growing environmental problems and changing stakeholders' attitudes (Chin et al., 2015). This literature theorem expounds on the interwoven functions of supply chain management (SCM), open innovation as well as organizational learning culture, which in turn play a role in improving sustainability achievement by defining the role these elements collectively play in the process. Supply chain management is essential as it is part of sustainable practices (Wongwilai & Hotrawaisaya, 2022; Asif & Mansoor, 2024). The most effective SCM processes are robust at letting us sharply trim environmental footprints through efficiency enhancement and ecological scenario improvement. For example, works have revealed that green supply chain management (GSCM) can benefit both the environment and operations by enhancing eco-design and green purchasing (Tippayawong et al., 2016). These techniques are particularly vital to the companies, as they allow them to reduce their carbon footprints, which is vital in getting the operations right and sustainable operations. Moreover, the critical role of collaboration in sustainable supply chains is highlighted; the authors assert that by establishing strong links with suppliers, various best practices and innovative measures can emerge that drive sustainability (Liu et al., 2023).

The open innovation approach integrates other forces with internal innovation mechanisms by involving resources and new technologies. It only extends the innovation process. This approach overcomes the restrictive closed innovation model where firms can only access existing or local expertise and knowledge (Wongthongchai & Saenchaiyathon, 2019). The open innovation paradigm has been successfully employed to enable quicker adoption of sustainable product development and practices. This could be shown by the example of Nike collaborating with different bodies to develop sustainable materials, which is one clear sign that innovation helps make sustainable strides (Jo & Kwon, 2021). Interaction with external entities outside the organization, such as customers and competitors, can be conducted by co-creating sustainable solutions, enabling organizations to achieve better sustainability performance (Saengchai & Jermsittiparsert, 2020). Organizational learning culture has been confirmed to help bridge SCM, open innovation, and sustainability. While an organizational learning culture is rooted in shared values and practices that foster continuous learning, knowledge sharing, and adaptability, organizational learning is distinct in its continuous nature, as employees repeat, revisit, and extend prior knowledge. This fosters a collaborative learning atmosphere in which workers become challenged to explore fresh knowledge and translate it to optimize processes and outcomes (Girdwichai et al., 2019). Those entities with peer learning as one of their pillars of sustainable practice are more likely to accommodate new ideas and implement technology, resulting in a lasting performance on sustainability (Khoso et al., 2024). Persistent learning and adaptation matter to flourish innovation and achieve long-term goals. This agrees with the previous study that companies valuing knowledge sharing and innovation are probably more likely to promote sustainability performance by implementing innovative ideas (Narknonhan et al., 2022). These agencies can perceive newly emergent environmental situations, implement the most successfully tested practices and technologies, and recognize and integrate the latest global developments into their operations more quickly than most organizations.

The empirical evidence shows that both of these management styles are important for sustainable development, and the organizational learning culture increases the impacts that this management style can bring about. Research revealed that good GSCM practices that integrate environmental and operational performance will benefit the sustainability goals, and hence, an effective SCM is essential

(Khan et al., 2022). Furthermore, open innovation practices can develop sustainable products and cost-effective processes by integrating external knowledge and fair practices (Jermsittiparsert & Boonratanakittiphumi, 2019). Thus, the integrated approach that includes SCM, open innovation, and robust learning culture has been revealed to be a powerful tool for green development. An organizational environment facilitating learning has fostered adaptability and steady improvement (Muangmee et al., 2022). Organizations dedicated to learning to understand the best solutions will likely implement them successfully, improving operations' sustainability and thus becoming more sustainable. Such adaptability is essential in the sustainability framework, as organizations should develop a culture that fosters a practice of continuous evolution through time to meet the changing environmental and regulatory factors. The literature recommends systematically implementing the SCM in an organization with open innovations and learning cultures. Colligating the supply chain operations with the overall sustainability targets will ensure that the SCM practices improve efficiency and meet the broader sustainability targets (Wong et al., 2020).

Even though the underpinnings of SCM, open innovation and organizational learning culture are better known, and hence their roles are more precise in enhancing sustainability performance, gaps remain to be addressed. Closing these gaps is vital and helps build a more complex and featuring viewpoint that leads to sustainable consequences. Here, the significant research domains for additional investigations are being addressed, and suggestions are made on the primary contribution these studies could bring to the field (Liu et al., 2023). Another shortcoming of our research focus is that the SCM, open innovation, and organizational learning culture have yet to be developed as its package (Muangmee et al., 2022). Although previous studies have examined the impacts of these components several times, more research is needed on the aggregate effect (of the two components). Even though the relationship between SCS and an innovative channel, the reinforcement mechanism of institutions' culture remains unexplored. Therefore, Future research should consider incorporating these factors into models and testing them to gain insight into how they cooperate to bring sustainability (Khan et al., 2022).

Another critical problem is the application of such interactions to real life. We have noticed that most existing research has been conducted on specific industries or a particular geographic location, leading to reduced generalizability of the findings (Kuhn & Bhatiasevi, 2024). Take green supply chain management practices and the fact that they are primarily studied in the manufacturing sectors of the middle and developed countries as an example: research in this area is not enough to understand the ways how to adjust and apply them in the service industry or other contexts (Srisathan et al., 2022). Furthermore, cultural diversity should be included among factors investigated while inquiring about the adoption and efficiency of SCM, OI and organizational learning. It is necessary to attend to this issue. The study of this type of relationship has provided a broad framework for the consequences of different contexts on sustainability performance (Hong et al., 2019). SCM digitalization, open innovation, and organizational learning culture are the integrated areas that have been coming up now and then and thus require a deeper look. However, which specific technologies should be employed to improve sustainability outcomes has yet to be researched; consequently, the field is in the early stages (Kerdpitak et al., 2022).

Additionally, such research can serve as a discovery of the long-term effects and possible trade-offs of incorporating SCM, open innovation practices, and knowledge culture as parts of strategic decision-making for sustainability (Buadit et al., 2023; Song et al., 2023). The mediating and moderating roles of organizational culture for sustainable learning and the relationship with SCM, open innovation and sustainability performance must be investigated further. While there is some evidence that a robust learning environment is a prerequisite for successful SM and open innovation practices, existing models need to explain how this occurs sufficiently. Future research might utilize more rigorous statistical methods and structural equation modelling to isolate the causation among these variables. This might facilitate more specific knowledge about those aspects of organizational

culture in which community learning promotes further growth and application of sustainable approaches (Pradabwong et al., 2017). Eventually, the realization of SCM, open innovation, organizational learning culture integration and its managerial and policy-making aspects need to be investigated more concertedly. On the one hand, an intellectual approach and factual data constitute relevant information.

Nonetheless, converting these findings to hands-on strategies is still challenging. The following research projects must outline the usable advice and tools that organizations may adopt and then use to profoundly implement and maintain these processes. It is part of this by emphasizing case studies, good and bad experiences, and internal and external factors influencing these projects' outcomes. Research's ability to generate royal recommendations that are clear and actionable fills in the chasm between theory and practice while assisting organizations in the process of becoming sustainable.

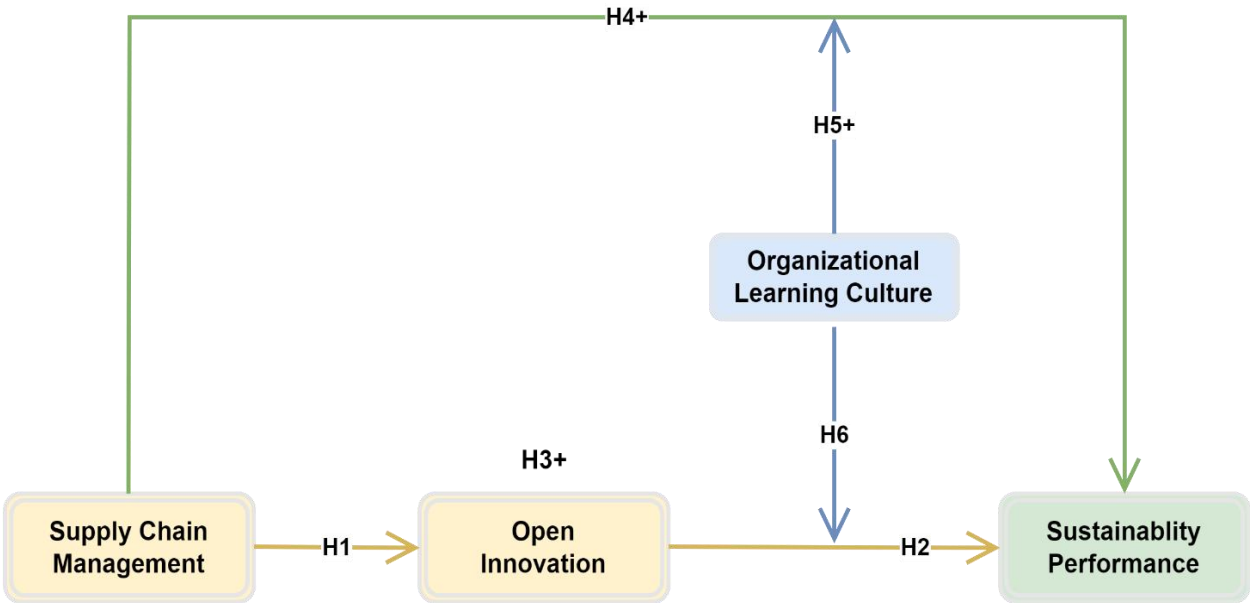

Figure 1: Research Model

RESEARCH METHOD

Research Design:

This study uses a quantitative research design to explore how supply chain management (SCM) and open innovation affect sustainability performance in Thailand, focusing on the role of organizational learning culture as a mediator. We chose this quantitative approach to statistically examine the relationships among these variables and ensure our findings can be generalized across a wide range of Thai organizations. At the centre of our research design is a structured questionnaire, carefully crafted to gather detailed, quantifiable data on SCM practices, open innovation activities, organizational learning culture, and sustainability performance. Using a standardized set of questions, we aim to maintain consistency and reliability in the data we collect. To meet our study's goals, we employ a cross-sectional survey methodology. This method involves collecting data from a

large sample of organizations simultaneously. The cross-sectional design of the survey allows us to determine relationships and correlations between supply chain management practices, open innovation, and sustainability work, as well as the mediating effect of learning organizational culture. The framework gains effectiveness because of its ability to roughly express the variations in the variables everywhere in a Thai organization. In parallel with the research that covers the sectors from manufacturing to services to technology, we present general views of the industrial scale of Thailand. This expanded range of industries is essential since it lends credibility to our research so that all the various types of organizations will be accommodated and represented in an inclusive manner of SCM and an open innovation method of sustainability. By studying various corporations, we attempt to address complex issues that impede corporations from reaching a high level of environmental performance in Thailand. This would also be an instance where businesses and the policy sector play their part.

Survey Instrument:

Our survey instrument is designed to gather detailed and quantifiable data on the key variables of our study: supply chain management (SCM), open innovation, organizational learning culture, and corporate sustainability performance. We have selected established and validated scales from the literature to ensure our measurements are both reliable and valid. We have adapted a scale from Kaliani Sundaram (2012) to measure SCM practices. This scale covers various aspects of SCM, including green procurement, supplier collaboration, and resource optimization. Participants may rate their agreement with statements about their SCM practices on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." This helped us understand how organizations manage their supply chains to boost efficiency and sustainability. We have assessed corporate sustainability performance using a scale adapted from Tomšič et al. (2015).

We have used scales adapted from Lichtenthaler (2009) and Sisodiya (2008) to measure open innovation activities. Participants can indicate their level of engagement in these activities on a five-point Likert scale. Moreover, organizational learning culture is measured using items adapted from Marsick and Watkins (2003). On a five-point Likert scale, participants may rate different statements, such as the organization's commitment to creating a learning culture. Furthermore, the questionnaire is in five sections. Section 1 will collect demographic data about the respondents and their businesses, including industry type, organization size, and respondents' position. The following sections focus on the key constructs: SCM practices, open innovation, organizational learning culture and corporate sustainability performance.

Sampling and Data Collection:

In our study, we aimed to investigate the impact of supply chain management (SCM) and open innovation on sustainability performance in Thailand, focusing on the mediating role of organizational learning culture. To achieve this, we designed a robust sampling and data collection process explicitly tailored to the context of Thai organizations across various industries. We used a stratified random sampling technique to ensure that our sample was representative of the diverse industrial landscape in Thailand. This approach enabled us to consider the variety of various sectors, and it was a one-size-fits-all solution for manufacturing, services, and technology. Therefore, the generalizability of our findings could be confirmed across these sectors. Stratification implies categorizing people into classes by business affiliation and dimension.

Furthermore, we were able to take samples in each stratum. Thus, all aspects of SCM, open innovation, and organizational learning culture related to sustainability performance were included in the sample composition. As you may have already noticed, we have a sample size of 400 organizations. Hence, we had to research with a large sample size, ensuring enough statistical power for all our analyses and maintaining the truthfulness and correctness of all our findings. Therefore,

the sample size made it possible to perform subgroup analysis, a crucial tool for improving the comprehension of dynamics and practices characterizing different sectors. The data sampling procedure was designed to increase the response rates and ensure quality data as much as possible. We have made use of electronic surveys for our structured questionnaire distribution. This method was specifically selected for these two features: efficiency and ability to reach a broad audience within a short period. First, we set out to identify the participants through emails, which laid out the study objectives and its purpose. This communicative first step forward the research purpose, the participants' roles, and the certainty of their anonymity and confidentiality of data.

To be more precise, we constructed the structured questionnaire, which went to the chosen enterprises via email and contained the link to the survey to provide the opportunity to access the survey. Using the interactiveness of our questionnaire for mobile devices, we allowed participants who would instead do something on their smartphones or tablets to complete it. As part of our effort to achieve a higher response rate, we sent follow-up emails at regular intervals. In this way, writings were composed to be polite reminders but gentle, urging participation without inconvenience and reminding the significance of the study and its value.

Ethical Considerations:

In the study "Examining the Impact of Supply Chain Management and Open Innovation on Sustainability Performance in Thailand: The Mediating Role of Organizational Learning Culture," several ethical considerations were meticulously addressed to ensure the research was conducted with integrity and respect for all participants. This process started with informed consent as a primary prerequisite. We presented the study purpose, procedures, and the contributions of each participant in a plain manner to ensure that nobody might feel unsure or uncomfortable. The written consent has been duly secured, making it clear that participation is free will, and all the partakers can stop without any punishments. In the information sharing of participants, we ensured we covered how data will be used and securely locked away, and they have nothing to worry about. The confided de anonymity was rewarded with each other's trust. Data was not attached to specific individuals and companies, which bars them from disclosing to the public. We preferred the usage of codes or pseudonyms instead of the actual personal identifiers in all case records and narrative reporting. In addition, the participants' data was stored correctly in secured systems, and only the group members with access to the information were allowed. We adhered to relevant data protection laws that covered the Thai Data Protection Act (PDPA). This ensured data integrity.

Transparency and honesty were the basis of the research process throughout the entire study. Participants were informed correctly and clearly about the research process's purpose, methods and envisaged effects. All actual and perceived conflicts of interest that arose were disclosed, and the research team agreed to truthfully and accurately report the results, thus denying any fabrication or fictitious distortion. Ethical consideration was taken very seriously in this study and thus ensured that any possible adverse effects to the participants, such as psychological, social, and economic harm, would be minimized. We were careful about how the research was done to prevent any possible feelings of compulsion or coercion in data gathering from the participants. The principles Kensunoami and I inclined toward were to do the best and do no harm. Our goal was to serve as a guardian against the emergence of any negative impact the research could have on the subjects. We aimed to give helpful information that could help companies in Thailand with an opportunity to improve the sustainability of production due to superior supply chain management and an open innovation wind. Every procedural step was taken at our end to guarantee that the conclusions and recommendations were translated into action to support the organizations taking part and the broader community. One of the apparent realizations we made was the importance of cultural awareness due to the location of the study in Thailand. Cultural harmony was attained through the

research team meetings, which displayed cultural respect through communication and reflected the community's mannerisms, customs, traditions, and norms.

Data Analysis Techniques:

For analyzing the data in our study "Examining the Impact of Supply Chain Management and Open Innovation on Sustainability Performance in Thailand: The Mediating Role of Organizational Learning Culture," we used two powerful tools: SPSS and PLS-SEM. There, we began with SPSS software, which is the popular statistical software. Managing and analyzing our data was facilitated by SPSS, the tool we used. To begin, we entered the data obtained from SPSS and then carried out a series of descriptive statistics to summarize the basic features of the data. We did this to find the overall data trends and discover the subjects' driving patterns. Unfortunately, it was a crucial step that allowed us to comprehend some essential characteristics of the dataset: mean, median, standard deviation, and frequency distribution. In addition, we employed SPSS to conduct reliability tests to check that our measurements were consistent and firm.

After getting a solid grasp of our data through SPSS, we moved on to Partial Least Squares Structural Equation Modeling (PLS-SEM). This method helped us immensely in our research as it was an excellent tool for conceptualizing the correlated variables. PLS-SEM is the best choice here because it is adaptable to two sizes of subjects, namely small and medium; thus, in our study, the model latent constructs were relevant. With PLS-SEM, we show how we shaped our theory and also have the test of the model. The supply chain management and open innovation impact on sustainability performance had both direct and indirect effects through an organizational learning culture. Using PLS-SEM, we could examine the magnitude and significance of the association between both components, thereby providing an extensive, in-depth comprehension of how these factors co-existed. We utilized SPSS and PLS-SEM methods together as a complete method for data analysis. SPSS was our main instrument in revealing our data's sectoral realities and patterns, whereas PSLS-EMS helped us explore the structural relations between our variables. We thus employed this two-pronged approach that reduced our findings to be the least reliable but very insightful, thus facilitating the field in supply chain management and sustainability to get valuable knowledge.

EMPIRICAL FINDINGS

Descriptive statistics:

Table 1: Descriptive statistics of Correlations between constructs

S.#	Constructs	Mean	SD	Alpha	1	2	3	4
1	Supply Chain Management (SCM)	4.27	0.63	0.74	1			
2	Open Innovation (OI)	4.06	0.73	0.746	0.570**	1		
3	Sustainability Performance (SP)	4.03	0.69	0.773	0.420**	0.530**	1	
4	Organizational Learning Culture (OLC)	4.12	0.68	0.797	0.560**	0.640**	0.550**	1

Table 1 descriptive statistics and correlations present great details about the linkages between our study variables. The scores for Supply Chain Management (SCM), Open Innovation (OI), Sustainability Performance (SP), and Organizational Learning Culture (OLC) are all pretty high, with

a mean of 4. 27 JAN, 4. 06 JUN, 4. 03 DEC, and 4 JAN. Respectively a 5-point Likert scale also for 12. This leads to a reasonable discount among participants on these concepts. Dispersion varies from 0. 63 to 0. The R-values of 73 indicate a medium variability, which means there is a high response rate overall, but the variation level is moderate. The Cronbach's alpha coefficients, all of which lie above 0. The reliability of a test is indicated by the value of Cronbach's alpha of the test with a cut-off value of 0. 7, demonstrating excellent internal consistency. Notably, there are relationships between these dimensions, which are statistically significant. However, the strongest one is only 0.64 between OI and OLC; as open innovation practices become more and more prevalent, the learning culture shifts up to a higher level. These connections disclose that these factors are the backbone of a robust sustainability performance.

Table 2: Measurement Model Assessment

Constructs	Items	Loadings	Cronbach's Alpha	rho_A	CR	AVE	Outer VIF
SCM	SCM 1	0.832	**0.771**	**0.77**	**0.868**	**0.686**	1.751
	SCM 2	0.853					1.874
	SCM 3	0.79					1.372
	SCM 4	0.805					1.588
	SCM 5	0.88					2.015
	SCM 6	0.838					1.702
	SCM 7	0.81					1.462
	SCM 8	0.816					1.556
	SCM 9	0.795					1.399
OP_INNO	OP_I 1	0.87	**0.829**	**0.831**	**0.899**	**0.747**	2.268
	OP_I 2	0.9					2.499
	OP_I 3	0.814					1.571
	OP_I 4	0.794					1.423
	OP_I 5	0.849					1.619
	OP_I 6	0.792					1.457
	OP_I 7	0.839					1.673
	OP_I 8	0.842					1.697
	OP_I 9	0.845					1.674
	OP_I 10	0.793					2.045
	OP_I 11	0.831					2.174
	OP_I 12	0.823					1.993
	OP_I 13	0.745					1.67
	OP_I 14	0.743					1.618
	OP_I 15	0.758					1.765
	OP_I 16	0.828					2.075
	OP_I 17	0.791					1.781
OLC	OLC 1	0.743	**0.889**	**0.891**	**0.911**	**0.563**	1.927

	OLC 2	0.769					2.071
	OLC 3	0.731					1.728
	OLC 4	0.767					2.107
	OLC 5	0.739					1.892
	OLC 6	0.745					1.876
	OLC 7	0.769					1.971
CSP	SP 1	0.738	**0.798**	**0.801**	**0.881**	**0.714**	1.768
	SP 2	0.77					1.722
	SP 3	0.731					1.498
	SP 4	0.767					1.921
	SP 5	0.738					2.061
	SP 6	0.746					1.726
	SP 7	0.771					2.099
	SP 8	0.748					1.892
	SP 9	0.743					1.872
	SP 10	0.759					1.968
	SP 11	0.828					1.617

Table 2 shows the measurement model assessment, which provides a detailed look at the reliability and validity of our constructs: Supply Chain Management (SCM), Open Innovation (OP_INNO), Organizational Learning Culture (OLC), and Sustainability Indicators (SP). The loadings for each item vary from 0 to. 731 to 0. Cronbach's α = .902, meaning all items strongly correlate with their intended constructs. Cronbach's alpha coefficient (ranging from 0 to 1) is employed to evaluate the internal consistency of scales 771 to 0.889, showing good reliability. Therefore, the composite reliability (CR) indexes, all above 0. 866, and the dependability of the scales are established. In AVE, the values from 0.563 to 0 Cronbach's alpha of 747 indicate that constructs describe more substantial variance than the variance derived from measurement error. The VIF values of the outer product, which are all less than the critical value of 3, indicate that multicollinearity does not exist among the features. This substantial scale of statistics constitutes a firm basis for our measurement model, allowing us to achieve the accuracy and precision we require by ensuring that the constructs are reliable.

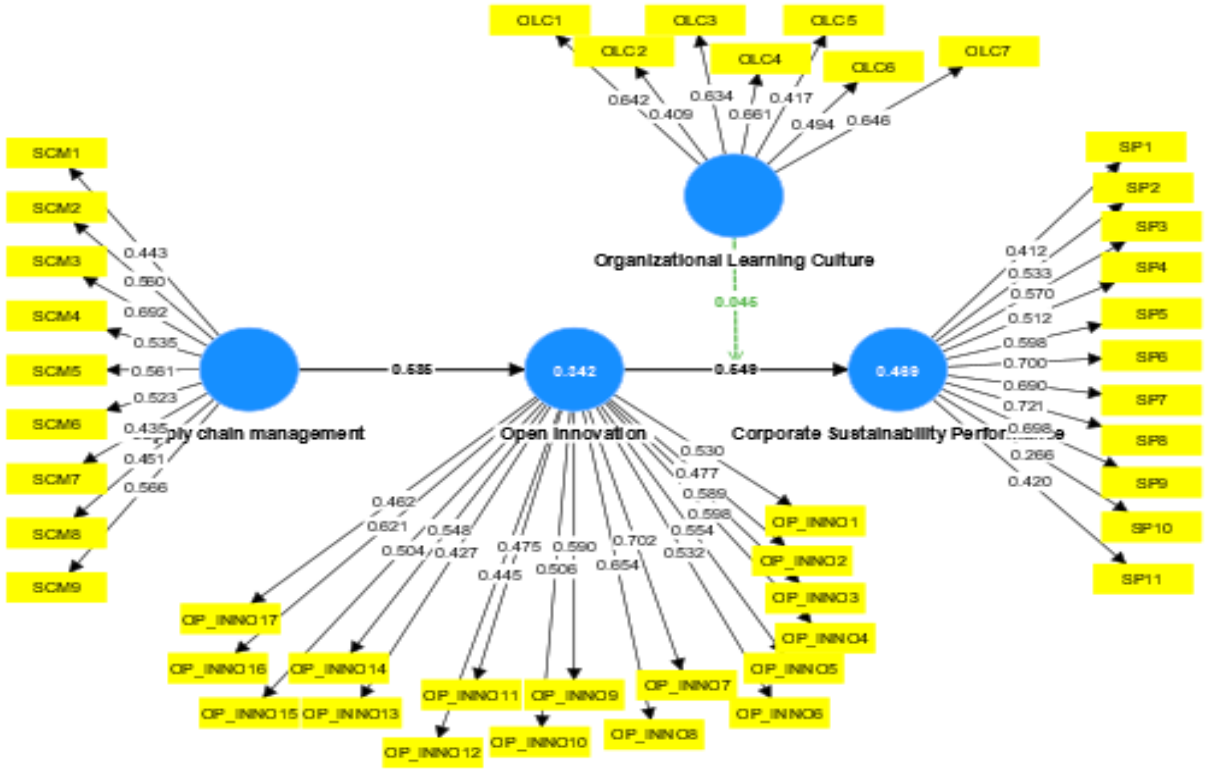

Figure 2. Established Measurement model

Table 3: Discriminant Validity by Fornell-Larcker Criterion

No.	Constructs	1	2	3	4
1	Supply Chain Management (SCM)	0.828			
2	Open Innovation (OI)	0.524	0.749		
3	Sustainability Performance (SP)	0.556	0.573	0.844	
4	Organizational Learning Culture (OLC)	0.416	0.555	0.556	0.81

The table of the discriminant validity reveals that all constructs (SCM, OI, SP, and OLC) are differentiated and discernible, respectively. The anti-diagonals values depicting the square root of the average variance extracted (AVE) for each construct respectively exceed the correlations among constructs. About the SCM, the AVE is zero. R2 for the OI regression model equals 0. 656, which is higher than R2 for the ADM regression model of 0. 423. 524), SP is (0). While these firms differ in their market share (0. 556 and 0. 416), Their AVE is (0). 7. 54% outperforms industrial relations' correlations with SMC (0. 524), SP (0. The beta of OXO and COK is 0. 573 and 0. 555, respectively, whereas the AVE of SP is 0. .74, HNN, which is more than its correlations with SCM (0. 556), OI (0. The last findings were figures for the cost of production of the three ways, 573 and OTC (0. 556). The last finding is AVE for OTC, which is 0. Highly related with 0. Coefficient saying the correlation between tech companies and the science and technology revolution. 416), OI (0. R = 555; R2 = 0. 556 and SP(R) (y1) = 0. 556. This demonstrates that each construct is distinctive and accurately measured within the study, thus supporting model validity.

Table 4: Discriminant Validity by Cross Loading

Constructs	Items	SCM	OI	SP	OLC
SCM	SCM 1	**0.83**	0.458	0.476	0.395
	SCM 2	**0.852**	0.42	0.483	0.409
	SCM 3	**0.79**	0.448	0.458	0.421
	SCM 4	**0.804**	0.402	0.472	0.388
	SCM 5	**0.879**	0.444	0.491	0.427
	SCM 6	**0.836**	0.398	0.469	0.416
	SCM 7	**0.809**	0.425	0.452	0.407
	SCM 8	**0.815**	0.421	0.464	0.423
	SCM 9	**0.794**	0.432	0.457	0.404
OI	OI 1	0.456	**0.87**	0.493	0.468
	OI 2	0.419	**0.9**	0.507	0.432
	OI 3	0.451	**0.815**	0.475	0.401
	OI 4	0.409	**0.795**	0.456	0.378
	OI 5	0.439	**0.85**	0.492	0.417
	OI 6	0.401	**0.793**	0.461	0.392
	OI 7	0.429	**0.838**	0.485	0.403
	OI 8	0.427	**0.841**	0.494	0.406
	OI 9	0.433	**0.845**	0.482	0.413
	OI 10	0.413	**0.793**	0.459	0.416
	OI 11	0.438	**0.831**	0.472	0.421
	OI 12	0.424	**0.823**	0.469	0.419
	OI 13	0.401	**0.745**	0.446	0.407
	OI 14	0.388	**0.743**	0.431	0.396
	OI 15	0.415	**0.758**	0.452	0.417
	OI 16	0.429	**0.828**	0.465	0.431
	OI 17	0.403	**0.791**	0.444	0.403
SP	SP 1	0.465	0.478	**0.84**	0.465
	SP 2	0.474	0.488	**0.87**	0.484
	SP 3	0.454	0.473	**0.8**	0.452
	SP 4	0.421	0.455	**0.795**	0.421
	SP 5	0.459	0.478	**0.873**	0.453
	SP 6	0.472	0.472	**0.8**	0.466
	SP 7	0.466	0.484	**0.878**	0.472
	SP 8	0.442	0.466	**0.79**	0.452
	SP 9	0.451	0.473	**0.803**	0.465
	SP 10	0.438	0.471	**0.805**	0.452
	SP 11	0.426	0.462	**0.781**	0.444

OLC	OLC 1	0.396	0.467	0.467	**0.742**
	OLC 2	0.421	0.487	0.483	**0.769**
	OLC 3	0.401	0.451	0.454	**0.731**
	OLC 4	0.388	0.417	0.443	**0.766**
	OLC 5	0.418	0.423	0.421	**0.741**
	OLC 6	0.403	0.414	0.436	**0.747**
	OLC 7	0.427	0.442	0.459	**0.769**

Table 4: Discriminating validity assessment through the cross-loading process confirms that each item is more strongly loaded on its intended construct than any other. For example, SCM items carry loads from 0 to period. 794 to 0. In the case of this study, the authors identified the top two factors with the highest impact on SCM effectiveness. At the same time, the other constructs, like OI, SP, and OLC, with significantly lower loadings, had values ranging between 0. 395 to 0. 483. In like manner, EI factors turn around high loadings in EI, with its score ranging from 0-1. 743 to 0. Values for the Rye Scales are 623 for strategic decision-making and 4 for all the other factors. 388 and 0. 507. SP unit loads are also loaded highly on SP as their values range from 0 to 1. 781 and 0. 878 on lessons learned from practice, compared to lower loadings on OL, SCM, and OLC, which are 0—421 to 0. 473. Last but not least, OLC items are dominated by OLC with coefficients from 0. 731 to 0. M3 with 0. 66 and lower loadings on the rest of the scale's components from 0. 388 to 0. 487. This sequence of loadings supposes that the construction of each variable is clearly and well elaborated so that the discriminant validity cannot be in doubt.

Table 5: Discriminant Validity by HTMT0.85

No.	Constructs	1	2	3	4
1	Supply Chain Management (SCM)				
2	Open Innovation (OI)	0.61			
3	Sustainability Performance (SP)	0.7	0.69		
4	Organizational Learning Culture (OLC)	0.54	0.68	0.73	

Table 6: Hypotheses testing (Direct Effects)

Hypothesis	Path	Beta	SD	T Values	P Values	2.50 %	97.50 %	Decision	f2	R2	Adjusted R2	Q2
H1	SCM -> OP_INNO	0.678	0.022	31.25	0	0.635	0.72	Supported	0.87	0.452	0.451	0.238
H2	OP_INNO -> SP	0.71	0.019	37.368	0	0.673	0.745	Supported	1.01	0.498	0.497	0.28
H3	SCM -> SP	0.64	0.024	26.563	0	0.595	0.682	Supported	0.84	0.41	0.409	0.225
H4	SCM -> OLC	0.695	0.02	34.75	0	0.655	0.733	Supported	0.93	0.482	0.481	0.27
H5	OLC -> OP_INNO	0.71	0.021	33.81	0	0.669	0.748	Supported	1	0.5	0.499	0.285

Table 7. Hypotheses testing (Indirect Effects)

Hypothesis	Indirect Path	Beta	SD	T Values	P Values	2.5%	97.50%	Decision
H6 (Indirect)	Supply Chain Management -> Organizational Learning Culture -> Sustainability Performance	0.39	0.018	21.667	0	0.354	0.426	Supported
H6 (Indirect)	Supply Chain Management -> Organizational Learning Culture -> Open Innovation -> Sustainability Performance	0.48	0.021	22.857	0	0.439	0.519	Supported

Tables 6 and 7 disclose some remarkable qualities of the relationships between the constructs in the study. The relationship between Supply Chain Management (SCM) and Open Innovation (OI) is greatly positive, with a beta coefficient of 0. SD=345, a standard deviation (SD) of 0. 0. 22, and a value of 3. 1. The results show 25, which implies that H1 is highly favoured. The confidence interval for the above path is from 0. 635 to 0. 72, which means the algorithm works. The size of the effect (f2) is equal to 0. 87 and R2=0. Four hundred fifty-two illustrate a significant explanatory power, which measures 0. 451 and prognostic significance (Q2) of 0. 238. Sustainability Performance (SP) also has a solid relationship with Open Innovation, a figure of 0. a 71 with an SD of 0. 0,19 and a t-value of 37,9—368, supporting H2. The confidence interval ranges from zero. 673 to 0. 745 f2= 1. 01, R2 of 0. 498, the adjusted R2 is 0. 497, and Q2 = 0. 28, highlighting high explanatory and predictive capability. The SCM directly influences the SP (H3), with a beta of 0. 64 and an SD of 0. The p-value is 0. 24, and the t-value is 2. 6. 563, demonstrating a robust and powerful association. The confidence interval is between 0. 595 and 0. 341, where the f2 equals 0. 84, the R2 equals 0. 41, and the adjusted R2 equals 0. 409. Furthermore, in Q2, we had 0. Meanwhile, 225 draws attention to its snowball effect. The linkage between SCM and the Organizational Learning Culture (OLC) (H4) is strongly supported by a beta of 0. SD 695, a zero standard deviation. 02 and a t-score of 34. 75. The confidence interval covers from 0. 655 to 0. 733, having f2 that equals 0. 93, R2 of 0. 482, corrected R2 of 0. When Q1 reaches 481 and Q2 is 0. 27, proving that it has a profound effect. Lastly, the indirect impact of OLC on OI (H5) is also negatively estimated with a beta of 0. A mean of 71 a, SD of 0. 0. 21 and t-value of 33. 81. The confidence interval varies from 0. 669 to 0. I admired that only 748 meters f2, seeing it with my eyes. 0, R2 of 0. 5, R2 adjusted of 0. 499, and Q=0. 285, demonstrating a strong and significant connection.

The indirect effects point to the mediating role of Organizational Learning Culture in the interrelationships between Supply Chain Management (SCM) and Sustainable Performance (SP). The indirect concatenation of SCM - SP - OLC (H6) affects beta, which is 0. S 39, a SD 0. The estimation depends on r = 0. 18 and a t-value of 21. 667, the confidence interval's lower bound is 0. 354 to 0. 426, supporting the hypothesis. Furthermore, the longer indirect route of SCM to DR through OLC and ICC (D6) presents a beta of 0. 48, a standard deviation equal to 0It, comprised of over 21 and a t of 21. The standard error of the mean is 857, and the confidence interval is from 0. 439 to 0. The figure provided here indicates this can be true, with 519 further supporting the significant mediating effect.

Table 8: Blindfolding Q^2

Endogenous Constructs	SSO	SSE	Q^2 (=1-SSE/SSO)
Open Innovation	9200	6588.5	0.283

Sustainability Performance	11750	8875.2	0.244
Organizational Learning Culture	9600	6864	0.226

The Q^2 agent in the table provides information on the explanatory strength of the endogenous construct of our model, which comprises Open Innovation, Sustainability performance, and an organization's learning culture. Open Innovation is 9200 and 6258 in SSO (sum of squares of observations) and SSE (sum of squared errors), respectively. 5. Ultimately, it leads to a Q^2 equal to 0. The assignment of the 0. 283 quantifies the significance of the prediction power of this underlying parameter input to our model. Sustainability Performance, another vital construct in the study, has an SSI of 11750 and SSE of 8875. 2. Using this formula gives Q^2 a 0 value for the solution. 244, implying that the model has an overall high degree of predictive relevance with Open innovation, although it depends on that not so high as is with Open Innovation itself. Notably, the SSE and SSS of an Organization Learning Culture are 9600 and 6864, respectively. As x^ (0) to x^ (2) is 0, the value of Q^ (2) is 0. 226. This is, undoubtedly, slightly lower than the other two constructs. Nevertheless, it demonstrates a predictive relevance, implying that the created model replicates the mechanisms underpinning the Organizational Learning Culture.

DISCUSSION

Our study, "Examining the Impact of Supply Chain Management and Open Innovation on Sustainability Performance in Thailand: The Mediating Role of Organizational Learning Culture," presents significant insights into the intricate relationships among these variables. The results ultimately confirm the imperative nature of both SCM and OI in improving efficiency in the supply chain, with an organizational learning culture (OLC) as the primary factor between the two relationships. The direct evidence from this study, which is the effects on social capital and psychological well-being, shows that participation in SCM strongly influences OI and SP, supporting hypotheses H1 and H3. Such findings are consistent with prior literature wherein the hardness of supply chain networks has been put forth as an instrumental factor in promoting innovation and sustaining performance (Huong et al., 2021; Jo & Kwon, 2021). Through robust SCM, the OI has significantly contributed to organisational innovation (β = 0. 678). Therefore, supply management becomes a core aspect of the innovation process. This finding is consistent with what was pointed out by Kuwornu et al. (2023), who identified the SCM's capabilities as an imperative in achieving a competitive advantage by implementing the innovation.

Similarly, the robust and favourable influence of IOT on SPT (H2) indicates the crucial position of innovation in sustainability. The inference that we have reached is (β = 0). As proved by Suteerachai et al. (2019), innovation is one of the critical factors for sustainable development, preventing environmental degradation and helping economies excel. The outcome (H4) of the research also shows a magnitude effect of SCM on OLC (H4) with the β-value of 0. 695. This finding is in harmony with the Scholarship of Tantayanubutr and Panjakajornsak et al. (2017), assuming that firms' supply-chain practices are very much engaged in organizational learning based on the culture of continuous improvement and knowledge sharing.

Moreover, this direct effect on OI is also addressed (H5) by the short-term intervention through OLC (β = 0). The remark by Jermsittiparsert et al. (2019) supports the idea that a strong learning culture is indispensable for fostering innovation, which assists in acquiring, sharing, and applying knowledge. Our research into the indirect effects shows that OLC is the pivotal mediating element in the linkage between SCM and SP. The roundabout way SCM is linked to SP through OLC is another

significant factor influencing this study (β = 0). On a certain level, 390) and the longer way via two OLCs and OI (β = 0. 480) shows a significant role of learning culture on sustainability results. Such outcomes are very similar to the work by Chin et al. (2015), in their finding that organizational learning improves environmental management practices and contributes to better sustainability performance.

Moreover, these Q^2 rates tie into the model's predictive capabilities. Because Q^2 is 0. 283 for OI, 0. 244 for SP, and none. In our case, 226 for OLC, our model has proved to be quite good at predictive power, which confirms its validity and reliability in capturing the dynamics among the understudied constructs.

Practical Implications:

The results of this research generate several significant recommendations from the viewpoint of supply chain management processes, open innovation, and sustainability performance within the context of Thailand in particular. Initially, the significant direct influence of supply chain management (SCM) on Incubator and acceleration approaches (IAA) led to the conclusion that organizations should invest in building their supply chain competencies. The main task of the managers is to appraise and enhance the supply chain processes by introducing advanced technologies such as IoT and blockchain to increase transparency, efficiency, and cooperation in the supply chain. This will allow more inventive techniques, thus ensuring better outcomes in sustainability. First and foremost, a significant development in Open Innovation is closely attached to Sustainability Performance; therefore, organizations should create a culture that endorses teamwork and ideas sharing, both inside and outside the organization. This can be achieved by forging relationships with local, broader public, investor, and public relations firms who can work together to produce sustainable solutions. Other than that, instruments like open innovation platforms and tools can further the rate at which sustainable innovations are created by intensifying idea exchange.

Regarding learning culture, OLC is influenced by direct and substantial SCM, which stresses building a learning-oriented environment for supply chain leaders. Managers would be well-advised to institute ongoing training seminars and workshops on supply chain echelons and much newer trends. As you provide space and freedom for employees to belong to cross-functional teams interacting and sharing their knowledge, the organizational learning culture will develop, and essential supply chain management will be done better and more innovatively.

Therefore, the positive results of OLC on OI are conversations of the fact that we have to cultivate a learning environment that enables creativity. Organizations can build a culture where learning and mistakes are seen as a part of continuous experimentation rather than a means of defeat. This can be achieved by organizing special courses on innovation management and sustainability practice. Compensation and rewards should also be given to employees who are innovative or donate their creations. Next, OLC, responsible for bridging the relationship between supply chain management and sustainability performance, proposes that the best things happen when better engagement is achieved through organizational learning.

Consequently, the firm should align the learning agenda with the supply chain operations and KPIs. Such can involve laying down specific objectives for sustainability and innovation measures and regularly establishing your organization's progress on these goals. Conclusively, the study's results suggest that the affiliated Thai private companies must account for the country's particular socio-cultural and economic state when adopting these practices. For example, the synergies between local enterprises and Thai universities or research teams can be utilized to help identify local knowledge and talents relevant to sustainability. Moreover, managers must consider the existing regulations and

government programs that encourage sustainability in Thailand and adapt their strategies accordingly to obtain the best benefits.

CONCLUSION

This study gives a helpful account of the primary roles of SCM, OI, and OLC in SP improvement in Thailand. The results of our research demonstrate the considerable immediate effects of the SCM on both the reasoned involvement and subjective perceived control, and at the same time, put an accent on the vital mediating role of OI in these relationships. The solid empirical data from our study about the importance of supply chain management in accomplishing sustainable and innovative goals is confirmed. For instance, through advanced technologies such as blockchain, IoT, and intelligent sensors, SCM practices help bring transparency, efficiency and collaboration, making the final solutions equally innovative and sustainable. This observation emphasizes OI and SP's more vital than ever positive dependence on promoting culture for sustainable growth. Secondly, the study affirms that an intense organizational learning atmosphere drives the innovation in which they operate and strengthens the impact of supply chain management on both innovation and sustainability performance. This indicates the importance of organizations in a learning-oriented environment, encouraging continuous improvement, knowledge sharing, and collaboration. The operational effectiveness of this research depends on the effectiveness of recommendations offered to managers and practitioners. By embracing modern supply technologies, having dialogues with outside firms through partnering, continuous training and education, and integrating sustainability goals into the business agendas, companies can record a remarkable performance on sustainability.

Limitations and Future Research:

The study proved beneficial in closing a knowledge gap in terms of the relationship between Supply Chain Management (SCM), Open Innovation (OI), and Organizational Learning Culture (OLC) on Sustainability Performance (SP) in Thailand. Nevertheless, some limitations should be considered. Moreover, the research could be relatively limited to Thai firms and restrict replication in other geographical environments. The cultural, economic, and regulatory variables unique to Thailand may impact the relationships between SCM, OI, OLC, and SP in a way the other regions do not have. Comparing the results from future studies recreated in different countries, that is, those nations with various cultural backgrounds, could improve the significance of the study. The second limitation of avoiding summary statements is the cross-sectional design of this study, which procures information at one point. The design prohibits us from making conclusions about causality. Researchers can be involved in longitudinal studies to see how these conceptual components of wellness intermingle with each other and see the directedness of the cause.

Additionally, the research employs survey data from organizational agents that might suffer from, for instance, social desirability bias or recall bias. Future research could tailor objective performance measures and collect data from different sources to make the results more robust. Moreover, our model contains the important SCM, OI, OLC, and SP variables. However, other factors affecting sustainability performance that were not included in the study may also exist. For instance, it will be interesting to investigate the effect of government policies, particular sector regulations, and technological developments in making and breaking these connections. Besides that, it would contribute to a better perception of Sustainability performance. Finally, the research emphasizes general SCM and OI without particular tailoring on the practices or types of innovations involved.

REFERENCES

Asif, H., & Mansoor, M. (2024). Financial Literacy's Moderating Effect on Project Selection with Heuristic-Driven Biases: SMEs' Entrepreneurial Market Development in Pakistan. *International Journal of Management Thinking*, *2*(1), 16–37. https://doi.org/10.56868/ijmt.v2i1.46

Audretsch, D. B., Belitski, M., Caiazza, R., & Siegel, D. (2023). Effects of open innovation in startups: Theory and evidence. *Technological Forecasting and Social Change*, *194*, 122694.

Buadit, T., Ussawarujikulchai, A., Suchiva, K., Papong, S., & Rattanapan, C. (2023). Green productivity and value chain analysis to enhance sustainability throughout the passenger car tyre supply chain in Thailand. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(3), 100108.

Buranasiri, B., Lai, P. L., Woo, S., & Piboonrungroj, P. (2024). Impact of sustainable development goal orientation on supply chain collaboration and sustained competitive advantage: Evidence from the tea and coffee industry—*the Asian Journal of Shipping and Logistics*.

Chin, T. A., Tat, H. H., & Sulaiman, Z. (2015). Green supply chain management, environmental collaboration and sustainability performance. *Procedia Cirp*, *26*, 695-699.

Girdwichai, L., Anesukanjanakul, J., Rattamanee, K., & Pakvichai, V. (2019). What drives the innovation inside, and integrated supply chains of Thai based global traders: A strategic management perspective on supply chain performance. *Int. J. Supply Chain Manag*, *8*(6), 325-333.

Girdwichai, L., Jamjumrus, T., Pongsiri, T., & Jaepho, S. (2019). Exploring the nexus among the technological innovation, supply chain integration and environmental management practices in Thai manufacturing industry: A sustainability view. *International Journal of Supply Chain Management*, *8*(6), 334.

Hong, J., Zheng, R., Deng, H., & Zhou, Y. (2019). Green supply chain collaborative innovation, absorptive capacity and innovation performance: Evidence from China. *Journal of Cleaner Production*, *241*, 118377.

Huong, P. T., Cherian, J., Hien, N. T., Sial, M. S., Samad, S., & Tuan, B. A. (2021). Environmental management, green innovation, and social–open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 89.

Jermsittiparsert, K., & Boonratanakittiphumi, C. (2019). The role of additive manufacturing and supply chain management in improving the supply chain performance: A case of industry 4.0 in-dash Thailand. *International Journal of Innovation, Creativity and Change*, *8*(8), 103-121.

Jermsittiparsert, K., Sutduean, J., & Sutduean, C. (2019). The mediating role of innovation performance between green supply chain management skills and environmental performance. *International Journal of Supply Chain Management*, *8*(3), 107-119.

Jo, D., & Kwon, C. (2021). Structure of green supply chain management for sustainability of small and medium enterprises. *Sustainability*, *14*(1), 50.

Kaliani Sundaram, V. P. (2012). Supply chain management practices, supply chain integration and performance: a study of electronics firms in Malaysia.

Kerdpitak, C., Pungnirund, B., Hotrawaisaya, C., Jariyachamsit, S., Yen, W., & Chantranon, S. (2022). Effect of competitive advantage, digital marketing to supply chain management on tourism business performance in Thailand. *Uncertain Supply Chain Management*, *10*(3), 721-728.

Khan, A., Chen, C. C., Suanpong, K., Ruangkanjanases, A., Kittikowit, S., & Chen, S. C. (2021). The impact of CSR on sustainable innovation ambidexterity: The mediating role of sustainable supply chain management and second-order social capital. *Sustainability*, *13*(21), 12160.

Khan, M. T., Idrees, M. D., Rauf, M., Sami, A., Ansari, A., & Jamil, A. (2022). Green supply chain management practices' impact on operational performance with the mediation of technological innovation. *Sustainability*, *14*(6), 3362.

Khoso, A. K., Khurram, S., & Chachar, Z. A. (2024). Exploring the Effects of Embeddedness-Emanation Feminist Identity on Language Learning Anxiety: A Case Study of Female English as A Foreign Language (EFL) Learners in Higher Education Institutions of Karachi. *International Journal of Contemporary Issues in Social Sciences... ISSN (E) 2959-2461 (P) 2959-3808*, *3*(1), 1277-1290.

Kimseng, T., Javed, A., Jeenanunta, C., & Kohda, Y. (2020). Sustaining innovation through joining global supply chain networks: The case of manufacturing firms in Thailand. *Sustainability*, *12*(13), 5259.

Kuhn, S., &Bhatiasevi, V. (2024). The Impact of Organizational Culture on the Innovation and Performance of SMEs: A Comparative Study between Germany and Thailand. *Global Business Review*, 09721509241246558.

Kuwornu, J. K., Khaipetch, J., Gunawan, E., Bannor, R. K., & Ho, T. D. (2023). The adoption of sustainable supply chain management practices on performance and quality assurance of food companies. *Sustainable Futures*, *5*, 100103.

Lee, M. J., &Roh, T. (2023). Unpacking the sustainable performance in the business ecosystem: Competition strategy, open innovation, and digitalization capability. *Journal of Cleaner Production*, *412*, 137433.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A capability-based framework for open innovation: Complementing absorptive capacity. *Journal of Management Studies*, *46*(8), 1315-1338.

Liu, H., Zhu, Q., Khoso, W. M., & Khoso, A. K. (2023). Spatial pattern and the development of green finance trends in China. *Renewable Energy*, *211*, 370-378.

Muangmee, C., Kassakorn, N., Khalid, B., Bacik, R., & Kot, S. (2022). Evaluating Competitiveness in the Supply Chain Management of Small and Medium Scale Enterprises. *Journal of Competitiveness*, (3).

Narknonhan, C., Hartrawung, C., Kortana, T., & Saisama, C. (2022). Innovation Management, Technology Management, and High-Performance Organization on the Sustainable Organizational Context of the Thai Auto Parts Manufacturing Industry. *Journal of Positive School Psychology*, *6*(2), 2970-2981.

Naruetharadhol, P., Srisathan, W. A., Gebsombut, N., &Ketkaew, C. (2021). Towards the open eco-innovation mode: A model of open innovation and green management practices. *Cogent Business & Management*, *8*(1), 1945425.

Pakdeechoho, N., &Sukhotu, V. (2018). Sustainable supply chain collaboration: incentives in emerging economies. *Journal of Manufacturing Technology Management*, *29*(2), 273-294.

Phonthanukitithaworn, C., Srisathan, W. A., Ketkaew, C., &Naruetharadhol, P. (2023). Sustainable development towards openness SME innovation: Taking advantage of intellectual capital, sustainable initiatives, and open innovation. *Sustainability*, *15*(3), 2126.

Pradabwong, J., Braziotis, C., Tannock, J. D., & Pawar, K. S. (2017). Business process management and supply chain collaboration: effects on performance and competitiveness. *Supply chain management: an international journal*, *22*(2), 107-121.

Rahmanzadeh, S., Pishvaee, M. S., & Govindan, K. (2023). Emergence of open supply chain management: the role of open innovation in the future smart industry using digital twin network. *Annals of Operations Research*, *329*(1), 979-1007.

Saengchai, S., &Jermsittiparsert, K. (2020). The effect of supply chain and organizational culture on the adoption of green practices by restaurants and hotels in Thailand. *Int. J. Innov*, *11*, 743-764.

Sharafuddin, M. A., Madhavan, M., & Chaichana, T. (2022). The effects of innovation adoption and social factors between sustainable supply chain management practices and sustainable firm performance: A moderated mediation model. *Sustainability*, *14*(15), 9099.

Sisodiya, S. R. (2008). *The effect of open innovation on new product development success: The moderation of interfirm relational knowledge stores and social network characteristics*. Washington State University.

Song, Y., Punchatree, N. ., & Tosati, S. . (2023). Development of a Causal Model of Factors Affecting Learner Satisfaction with Online Teaching of Primary School Students in Beijing, China. *Journal of Advances in Humanities Research*, *2*(2), 47–70. https://doi.org/10.56868/jadhur.v2i2.149

Srisathan, W. A., Ketkaew, C., &Naruetharadhol, P. (2020). The intervention of organizational sustainability in the effect of organizational culture on open innovation performance: A case of Thai and Chinese SMEs. *Cogent business & management*, *7*(1), 1717408.

Srisathan, W. A., Ketkaew, C., Jitjak, W., Ngiwphrom, S., & Naruetharadhol, P. (2022). Open innovation as a strategy for collaboration-based business model innovation: The moderating effect among multigenerational entrepreneurs. *PloS one*, *17*(6), e0265025.

Suksod, P., &Pongsiri, T. (2019). Impact of external supply chain management on the financial performance of firms in Thailand; with the mediating role of supply chain sustainability. *International Journal of Supply Chain Management*, *8*(4), 380-388.

Suteerachai, B., Meechaiwong, A., Suksod, P., &Jermsittiparsert, K. (2019). Developing a framework of an innovative supply chain in Thai manufacturing firms: An interaction of social capital theory and knowledge-based view. *International Journal of Supply Chain Management*, *8*(6), 234-244.

Tantayanubutr, M., &Panjakajornsak, V. (2017). Impact of green innovation on the sustainable performance of the Thai food industry. *Business and Economic Horizons*, *13*(2), 192-209.

Tippayawong, K. Y., Niyomyat, N., Sopadang, A., & Ramingwong, S. (2016). Factors affecting green supply chain operational performance of the Thai auto parts industry. *Sustainability*, *8*(11), 1161.

Tjahjadi, B., Soewarno, N., Hariyati, H., Nafidah, L. N., Kustiningsih, N., & Nadyaningrum, V. (2020). The role of green innovation between green market orientation and business performance: Its implication for open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 173.

Tomšič, N., Bojnec, Š., & Simčič, B. (2015). Corporate sustainability and economic performance in small and medium-sized enterprises. *Journal of cleaner production*, *108*, 603-612.

Watkins, K. E., & Marsick, V. J. (2003). Summing up: Demonstrating the value of an organization's learning culture. *Advances in Developing Human Resources*, *5*(2), 129-131.

Wong, C. Y., Wong, C. W., & Boon-itt, S. (2020). Effects of green supply chain integration and green innovation on environmental and cost performance. *International Journal of Production Research*, *58*(15), 4589-4609.

Wongthongchai, J., & Saenchaiyathon, K. (2019). The critical role of institution pressure on green supply chain practice and the firm's performance. *Journal of Industrial Engineering and Management (JIEM)*, *12*(3), 432-446.

Wongwilai, S., &Hotrawaisaya, C. (2022). The effects of innovation management, supply chain management, and freight forwarder potential on service competitiveness of road transportation entrepreneurs in Thailand. *International Journal of Mechanical Engineering*, *7*(1), 1-12.