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An Empirical Investigation of Factors Influencing Innovation and Organizational Performance among Logistics and Supply Chain Organizations in Thailand

Rawin VONGURAI¹

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Abstract

Purpose: As Thailand endeavors to solidify its position in the global supply chain, unraveling the determinants of innovation and performance becomes imperative for sustained competitiveness. This research delves into the multifaceted landscape of logistics and supply chain organizations in Thailand, aiming to identify and understand the key factors that significantly influence innovation and organizational performance in this dynamic sector. **Research design, data, and methodology:** A questionnaire is developed to survey to 400 employees who have at least one-year experience in selected ten logistics and supply chain organizations in Thailand. The sampling techniques involved judgmental, convenience and snowball sampling. Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) were employed to assess and validate the model's adequacy and to conduct hypothesis testing. **Results:** The findings reveal that ICT use significantly influenced entrepreneurial orientation and innovation but has no significant influence on organizational performance. Additionally, innovation was significantly influenced by collective entrepreneurship but not by entrepreneurial orientation. Finally, innovation significantly influenced organizational performance. **Conclusions:** The study concludes with actionable insights for logistics and supply chain organizations in Thailand. This research serves as a valuable resource for practitioners, policymakers, and researchers seeking to advance the understanding of organizational dynamics in this critical industry.

Keywords : ICT, Innovation, Organizational Performance, Logistics, Supply Chain

JEL Classification Code : M10, M31, L61, L62, O30

1. Introduction

The surge in Thailand's logistics sector began with the nation's embrace of free trade agreements with foreign nations. Subsequently, a multitude of international corporations spanning diverse industries-initiated operations within Thailand, engaging in collaborative ventures with local enterprises (International Trade Administration, 2022). This necessitated an expansion of

logistics activities across the country to effectively support comprehensive supply chain operations. Over the past decade, the logistics industry has consistently contributed to the nation's GDP growth. However, this positive trajectory faced a disruption in 2020 due to the unprecedented impact of the COVID-19 pandemic (Statista Research Department, 2023).

Amidst the challenges posed by the COVID-19 pandemic, the shipment volumes in road, air, and water

¹ First Author and Corresponding Author. Program Director, Innovative Technology Management, Graduate School of Business and Advanced Technology Management, Assumption University, Thailand. Email: rawinvng@au.edu

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transportation experienced a significant decline due to the stringent restrictions implemented to combat the virus. In the realm of road transportation, constraints such as curfews and restricted border access emerged as primary factors contributing to the reduced delivery volume (Alamoush et al., 2022). Similar to the global trend, Thailand's air transportation witnessed substantial downsizing, resulting in a persistent decline in air freight volume that is yet to recover as of 2022 (Statista Research Department, 2023).

Paradoxically, the pandemic spurred a notable surge in online consumer activity in Thailand. The restrictions and safety concerns prompted Thai consumers to embrace e-commerce platforms more fervently than ever before. This surge, in turn, fueled the expansion of the e-commerce market, bringing about significant advantages for last-mile delivery services across the country (Oosga, 2023).

As of 2022, key sectors such as food, personal care, and electronics emerged as the frontrunners in Thailand's e-commerce landscape, capturing the highest market share among the various segments (Amornkitvikai et al., 2022). Despite the setbacks faced by traditional transportation modes, the resilience and adaptability of the e-commerce sector have played a pivotal role in shaping the dynamics of Thailand's delivery landscape in the wake of the pandemic. Thailand's strategic geographical positioning bestows upon it a multitude of advantages, positioning the nation as a key contender to emerge as a regional hub for air, water, and multi-modal transportation (Ketudat & Jeenanunta, 2021). Consequently, the logistics industry in Thailand is marked by intense competition, not only amongst local operators but also involving international entities (Suangsub et al., 2022). In the first quarter of 2023, the top-performing companies in the logistics sector included BEM, with Prima Marine Public Company Limited (PRM) achieving the highest net profit. Remarkably, PRM secured a leading position in the industry (Statista Research Department, 2023).

Turning attention to the courier industry, the state-owned Thailand Post asserted its dominance, holding the largest market share in the express delivery sector within Thailand for the same period. Following closely was Kerry Express, headquartered in Hong Kong, marking a competitive landscape where both local and international players contribute to the vibrant and dynamic logistics environment in the country (Polyos, 2021).

The logistics and supply chain sector in Thailand is undergoing rapid evolution amidst the challenges and opportunities presented by technological advancements, market dynamics, and global interconnectedness (Bandoophanit et al., 2023). Despite its significance in contributing to the country's economic growth, there exists a critical gap in understanding the intricate interplay of factors influencing innovation and organizational performance within this dynamic industry.

While existing literature acknowledges the importance of innovation and organizational performance in logistics and supply chain organizations, there is a notable research gap specific to Thailand. Current studies often lack a comprehensive exploration of the multifaceted landscape in this country, particularly in identifying and understanding the key factors that distinctly influence innovation and organizational performance. Moreover, a nuanced investigation into the interconnected roles of ICT use, entrepreneurial orientation, collective entrepreneurship, innovation, and organizational performance within the Thai logistics and supply chain context is conspicuously absent. Therefore, this study aims to evaluate the impact of identified factors on the innovative capacity and overall performance of logistics and supply chain organizations in Thailand. By addressing these objectives, the research endeavors to contribute valuable insights that can guide stakeholders, policymakers, and industry practitioners in fostering innovation and enhancing organizational performance within the logistics and supply chain sector in Thailand.

2. Literature Review

2.1. ICT Use (ICT)

Information and Communication Technology (ICT) plays a pivotal role in shaping the landscape of logistics and supply chain management, providing organizations with tools to enhance efficiency, transparency, and responsiveness (Papachristos et al., 2023). Yunis et al. (2017) explores the multifaceted implications of ICT use in this dynamic sector, highlighting its impact on innovation and organizational performance. Effective supply chain management requires real-time visibility, and ICT integration facilitates this by enabling seamless communication and data sharing across the supply chain (Oncioiu et al., 2019). The use of technologies such as RFID, IoT, and cloud computing enhances visibility, reducing uncertainties and improving decision-making processes (Unhelkar et al., 2022).

Several research studies validate the positive impact of Information and Communication Technology (ICT) on firms' productivity and market share (Cardona et al., 2013; Koellinger, 2008; Tran et al., 2014; Yunis et al., 2017). Entrepreneurial orientation, characterized by a propensity for calculated risk-taking, finds support in the capabilities of ICT. Through advanced analytics and predictive modeling, ICT empowers organizations with valuable insights into potential risks and rewards, facilitating a more informed and confident approach to risk-taking within the realms of logistics and supply chain management (Saleh & Athari, 2023).

Information and Communication Technology (ICT) has the potential to aid a company in the introduction of novel products and services, fostering a more customer-centric approach and enabling improved responsiveness to market changes, ultimately driving innovation (Brynjolfsson & Saunders, 2010). Consequently, when coupled with the dynamic capabilities of the firm, ICT serves to amplify both efficiency and innovation within the organization (Melville et al., 2004). Yunis et al. (2017) highlighted that innovations and applications (Apps) based on Information and Communication Technologies (ICT) have become significant catalysts for improving organizational performance, fostering economic growth, and instigating cultural change. Building upon this discourse, the formulation of hypotheses is warranted:

- H1:** ICT use has a significant influence on entrepreneurial orientation.
H2: ICT use has a significant influence on innovation.
H3: ICT use has a significant influence on organizational performance.

2.2. Entrepreneurial Orientation (EO)

According to Makhdoom et al. (2019), entrepreneurial orientation has emerged as a critical organizational mindset that fosters innovation, risk-taking, and proactive engagement with the business environment. Innovation is a central element of entrepreneurial orientation, reflecting an organization's commitment to introducing new products, services, or processes. Innovative practices enable firms to stay ahead in competitive markets, adapt to changing customer needs, and exploit emerging opportunities (Arunachalam et al., 2018).

Entrepreneurial orientation has consistently been linked to increased innovation within organizations. Firms exhibiting a higher degree of EO tend to be more innovative, introducing new products, services, or processes to stay ahead in competitive markets (Rubera & Kirca, 2017). Innovation is considered one of the fundamental components of Entrepreneurial Orientation. Firms with a high EO demonstrate a propensity for exploring novel ideas, technologies, and market opportunities, leading to the creation of innovative products and services (Anwar et al., 2022). Therefore, this study puts forth the following hypotheses:

- H4:** Entrepreneurial orientation has a significant influence on innovation.

2.3. Collective Entrepreneurship (CE)

Collective entrepreneurship, often referred to as collaborative entrepreneurship, represents a strategic

approach where individuals and entities pool their resources, skills, and efforts to pursue entrepreneurial activities collectively (Makhdoom et al., 2019). The drive for innovation performance cannot solely be attributed to a single entrepreneur or owner. Considering an entrepreneur or owner as the sole driver of innovation activities tends to reinforce a strong individualistic assumption about entrepreneurship (Man et al., 2002).

Collective entrepreneurship emerges as a dynamic and influential force in fostering innovation within organizational settings (Yan & Sorenson, 2003). By promoting collaboration, knowledge sharing, and a culture of collective creativity, this approach enhances the ability of individuals and organizations to navigate challenges and capitalize on opportunities, contributing significantly to the innovation process (Yan & Yan., 2016). Based on above literature, a hypothesis is set as follows:

- H5:** Collective entrepreneurship has a significant influence on innovation.

2.4. Innovation (IN)

Innovation, broadly defined as the introduction of novel ideas, processes, products, or services, plays a pivotal role in shaping the trajectory of organizational performance (Tidd & Bessant, 2020). Odumeru (2013) suggests that innovation is a widely embraced strategy in contemporary economies for most organizations. In the words of Robbins and Coulter (2006), innovation is delineated as the process of transforming creative ideas into practical products or efficient work methods. This stands in contrast to invention, which the authors define as the process of generating new ideas.

Numerous studies underscore the positive influence of innovation on organizational performance. Innovations in products, processes, or business models are often associated with enhanced efficiency, increased market share, and improved financial outcomes (Dodgson et al., 2008; Makhdoom et al., 2019; Yunis et al., 2017). Different types of innovation, including product innovation, process innovation, and organizational innovation, have varying impacts on organizational performance (Salim & Sulaiman, 2011). For instance, product innovation is linked to improved market competitiveness, while process innovation enhances operational efficiency and cost-effectiveness (Avermaete et al., 2003). Therefore, a hypothesis is suggested:

- H6:** Innovation has a significant influence on organizational performance.

2.5. Organizational Performance (OP)

Organizational performance is a multifaceted construct that reflects the effectiveness of an organization in achieving

its goals and objectives. It encompasses various dimensions such as financial success, operational efficiency, customer satisfaction, and employee productivity (Richard et al., 2009). Financial indicators, including profitability, return on investment, and revenue growth, are commonly used to assess organizational performance. These metrics provide a quantitative measure of the financial health and sustainability of an organization (Ittner & Larcker, 2003). Effective leadership is a critical determinant of organizational performance. Transformational leadership, in particular, has been linked to improved employee motivation, innovation, and overall organizational success (Bass & Riggio, 2006). The examination of how innovation affects firm performance has been a subject of considerable interest for economists and policymakers over the years, as studied by Hashi and Stojic (2013). Despite the general perception that innovation is a mechanism for enhancing the competitiveness of firms and their performance in both domestic and foreign markets, empirical evidence supporting this relationship has not been consistently established in the existing literature (Alhadid & Abu-Rumman, 2014).

3. Research Methods and Materials

3.1. Research Framework and Hypotheses

This empirical investigation shed light on the intricate interplay of factors influencing innovation and organizational performance within Thailand's logistics and supply chain sector. The conceptual framework draws inspiration from the works of Makhdoom et al. (2019) and Yunis et al. (2017), depicted in Figure 1. Within this framework, four dependent variables are identified: ICT Use (ICT), Entrepreneurial Orientation (EO), Collective Entrepreneurship (CE), and Innovation (IN). The independent variable under consideration is Organizational Performance (OP).

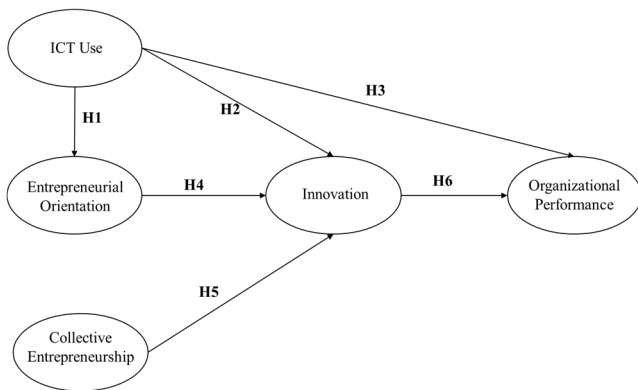


Figure 1: Conceptual Framework

- H1:** ICT use has a significant influence on entrepreneurial orientation.
- H2:** ICT use has a significant influence on innovation.
- H3:** ICT use has a significant influence on organizational performance.
- H4:** Entrepreneurial orientation has a significant influence on innovation.
- H5:** Collective entrepreneurship has a significant influence on innovation.
- H6:** Innovation has a significant influence on organizational performance.

3.2. Methodology

This study adopted a quantitative research methodology, employing an online distribution approach from August to October 2023. The survey instrument consisted of three distinct sections: preliminary screening questions (2), items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (31), and demographic questions (4). In preparation for data collection, content validity was rigorously ensured by verifying an item-objective congruence (IOC) index score surpassing 0.5.

Prior to the main data collection, a pilot test was conducted with a sample size of 30 participants. The results of this reliability test indicated favorable Cronbach's alpha coefficient values, surpassing the acceptable threshold of 0.7, as outlined by Nunnally and Bernstein (1994).

For subsequent data analysis, the chosen statistical techniques were confirmatory factor analysis (CFA) and structural equation modeling (SEM). These methods were employed to evaluate the goodness of fit of the proposed model and to test the formulated hypotheses. Throughout this analytical phase, various statistical tools were utilized to ensure a robust examination of the data.

3.3. Population and Sample Size

The focus of this study is on individuals with a minimum of one year of experience within ten specifically chosen logistics and supply chain organizations in Thailand. The disclosure of the names of the ten companies is withheld as official consent has not been granted. The structural equation model, a statistical technique used for analyzing complex relationships, recommends a sample size of at least 200 respondents for robust and reliable results (Kline, 2011). To ensure a comprehensive dataset, an online survey was distributed to approximately 500 participants. After thorough scrutiny, 400 responses were deemed valid, meeting the criteria necessary to proceed with the subsequent data analysis phase.

3.4. Sampling Technique

The sampling strategy employed in this research comprises judgmental, convenience, and snowball sampling techniques. Initially, the researcher specifically selected employees with a minimum of one year of experience within ten chosen logistics and supply chain organizations in Thailand. Although the availability of the employee count could have facilitated a quota, the researcher opted for convenience sampling. Subsequently, the researcher utilized an online survey distributed through Google Forms to reach voluntary respondents without ensuring proportionate distribution. To enhance reach, the researcher utilized direct communication channels such as emails, LinkedIn, and the Line chat application to engage with the identified group. Lastly, the researcher incorporated snowball sampling, encouraging participants to share the online survey link with their qualified peers and colleagues, thereby expanding the scope of the study. This combination of sampling techniques ensures a diverse and representative participant pool for the research investigation.

4. Results and Discussion

4.1. Demographic Profile

The demographic data collected from the survey of 400 participants provides valuable insights into the composition of the participant pool, offering a nuanced understanding of the sample characteristics. The analysis encompasses gender distribution, age groups, educational backgrounds, and professional roles. The study boasts a well-balanced representation of genders, with 50.3% male and 49.8% female participants. Notably, the majority falls within the 31-40 years old category, comprising 36.3% of the sample. The educational diversity of the participants is noteworthy, with the majority holding at least a Bachelor's degree (72.3%). The study's sample spans a wide array of professional roles, showcasing the organizational diversity within the logistics and supply chain domain. Administration acquires the largest group of 71 participants (17.8%), whereas the smallest group is others (3.5%).

Table 1: Demographic Profile

Demographic Information		Frequency	%
Gender	Male	201	50.3%
	Female	199	49.8%
Age	Below 30 years old	89	22.3%
	31-40 years old	145	36.3%
	41-59 years old	101	25.3%
	50 Years Old and above	65	16.3%
Education Level	Below Bachelor's degree	21	5.3%
	Bachelor's degree	289	72.3%
	Master's degree	68	17%
	Doctorate degree	22	5.5%
Job Role	C-Level	32	8%
	Sales/Marketing	65	16.3%
	Finance/Accounting	45	11.3%
	Human Resources	68	17%
	Administrations	71	17.8%
	Product Development	47	11.8%
	Information Technology	58	14.5%
	Others	14	3.5%

4.2. Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is a statistical technique widely employed in social sciences and behavioral research to validate and assess the reliability of a predefined measurement model. Unlike exploratory factor analysis, which uncovers latent factors from observed variables, CFA tests a predefined hypothesis about the structure of relationships among variables (Brown, 2006).

Within Confirmatory Factor Analysis (CFA), the examination of data involved an assessment of both convergence validity and discriminant validity. Internal consistency was evaluated using Cronbach's Alpha, adhering to the criterion that the value must be 0.70 or higher (Nunnally & Bernstein, 1994), as presented in Table 2. Acceptability was determined based on criteria such as t-values exceeding 1.98, p-values below 0.5, and factor loadings surpassing 0.5 (Hair et al., 2010).

Furthermore, the analysis considered composite reliability (CR), which exhibited significance at 0.7 and above for all constructs, and average variance extracted (AVE), surpassing 0.5 (Fornell & Larcker, 1981). These criteria ensured the robustness of the estimates, confirming both convergence validity and discriminant validity within the measurement model.

Table 2: Confirmatory Factor Analysis Result, Composite Reliability (CR) and Average Variance Extracted (AVE)

Variables	Source of Questionnaire	No. of Items	Cronbach's Alpha	Factors Loading	CR	AVE
1. ICT Use (ICT)	Yunis et al. (2017)	6	0.865	0.685-0.754	0.866	0.519
2. Entrepreneurial Orientation (EO)	Makhdoom et al. (2019)	6	0.869	0.555-0.850	0.870	0.533
3. Collective Entrepreneurship (CE)	Yan and Sorenson (2003)	3	0.761	0.604-0.809	0.777	0.540
4. Innovation (IN)	Yunis et al. (2017)	8	0.873	0.635-0.710	0.874	0.466
5. Organizational Performance (OP)	Yunis et al. (2017)	6	0.849	0.597-0.750	0.851	0.490

Note: CR = Composite Reliability, AVE = Average Variance Extracted

The evaluation of discriminant validity, as outlined by Fornell and Larcker (1981), entails the calculation of each variable's square root of Average Variance Extracted (AVE). In the specific context of this study, the affirmation of discriminant validity stems from the calculated values surpassing all inter-construct or factor correlations. This signifies that each construct is more correlated with its own measures than with measures of other constructs, establishing the distinctiveness of the constructs under consideration.

Additionally, the analysis addressed the potential issue of multicollinearity by examining correlation coefficients. The results, presented in Table 3, indicated no substantial concerns regarding multicollinearity. This conclusion was drawn as the factor correlations did not exceed the commonly recognized threshold of 0.80 (Studenmund, 1992). The absence of high correlations among factors suggests that the variables are relatively independent, contributing to the robustness and reliability of the measurement model in the study.

Table 3: Discriminant Validity

	IN	ICT	EO	CE	OP
IN	0.682				
ICT	0.659	0.720			
EO	0.220	0.262	0.730		
CE	0.675	0.557	0.270	0.735	
OP	0.673	0.512	0.305	0.625	0.700

Note: The diagonally listed value is the AVE square roots of the variables

SEM begins with the establishment of a measurement model, specifying relationships between latent (unobserved) constructs and their observable indicators (Byrne, 2010). The assessment of the measurement model in Confirmatory Factor Analysis (CFA) involved evaluating the goodness of fit. This study employed various criteria, namely CMIN/DF, GFI, AGFI, NFI, CFI, TLI, IFI, and RMSEA, as outlined in Table 4. Notably, all the computed values adhered to the established acceptance criteria without requiring any adjustments. Consequently, the convergent and discriminant validities of this study were validated, affirming the reliability and appropriateness of the measurement model.

Table 4: Goodness of Fit of Measurement Model

Index	Acceptable Values	Measurement Model
		Statistical Values (No Model Adjustment)
CMIN/DF	< 3.00 (Hair et al., 2006)	593.914/367 = 1.537
GFI	≥ 0.85 (Kline, 2011)	0.911
AGFI	≥ 0.85 (Kline, 2011)	0.895
NFI	≥ 0.85 (Kline, 2011)	0.898
CFI	≥ 0.85 (Kline, 2011)	0.962

Index	Acceptable Values	Measurement Model
		Statistical Values (No Model Adjustment)
TLI	≥ 0.85 (Kline, 2011)	0.957
IFI	≥ 0.85 (Kline, 2011)	0.962
RMSEA	≤ 0.08 (Hooper et al., 2008)	0.037
Model summary		Acceptable Model Fit

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = goodness-of-fit index, AGFI = adjusted goodness-of-fit index, NFI = normalized fit index, CFI = comparative fit index, TLI = Tucker-Lewis index, IFI = Incremental Fit Index, and RMSEA = root mean square error of approximation

4.3. Structural Equation Model (SEM)

The structural model explores the relationships among latent constructs, offering insights into the direct and indirect effects between variables (Kline, 2011). SEM model fit is assessed using indices (Hu & Bentler, 1999). In Table 5, the indices and values of the goodness of fit were acceptable with no model adjustment, including CMIN/DF = 2.006, GFI = 0.893, AGFI = 0.875, NFI = 0.865, CFI = 0.927, TLI = 0.920, IFI = 0.928, and RMSEA = 0.050 respectively.

Table 5: Goodness of Fit of Structural Model

Index	Acceptable Values	Structural Model
		Statistical Values (No Model Adjustment)
CMIN/DF	< 3.00 (Hair et al., 2006)	744.334/371 = 2.006
GFI	≥ 0.85 (Kline, 2011)	0.893
AGFI	≥ 0.85 (Kline, 2011)	0.875
NFI	≥ 0.85 (Kline, 2011)	0.865
CFI	≥ 0.85 (Kline, 2011)	0.927
TLI	≥ 0.85 (Kline, 2011)	0.920
IFI	≥ 0.85 (Kline, 2011)	0.928
RMSEA	≤ 0.08 (Hooper et al., 2008)	0.050
Model summary		Acceptable Model Fit

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = goodness-of-fit index, AGFI = adjusted goodness-of-fit index, NFI = normalized fit index, CFI = comparative fit index, TLI = Tucker-Lewis index, IFI = Incremental Fit Index, and RMSEA = root mean square error of approximation

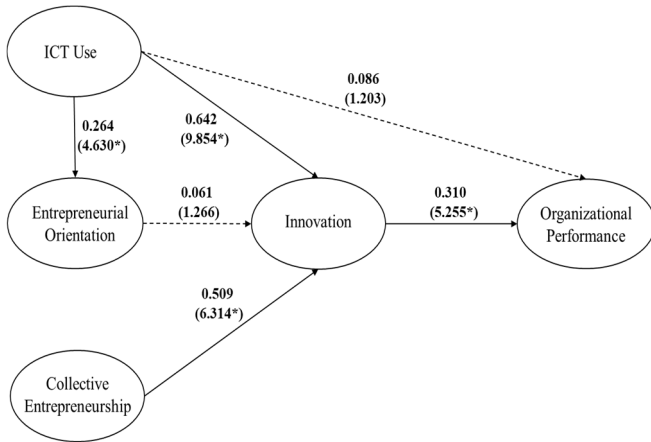
4.4. Research Hypothesis Testing Result

The outcomes of hypothesis testing, derived from the regression weights and R² variances, are presented in Table 6. The significance level, affirming statistical support, is established at p = 0.05.

Table 6: Hypothesis Result of the Structural Model

H	Paths	(β)	S.E.	t-Value	Tests Result
H1	EO <--- ICT	0.264	0.063	4.630*	Supported
H2	IN <--- ICT	0.642	0.061	9.854*	Supported
H3	OP <--- ICT	0.086	0.063	1.203	Not Supported
H4	IN <--- EO	0.061	0.041	1.266	Not Supported
H5	OP <--- CE	0.310	0.073	5.255*	Supported
H6	OP <--- IN	0.509	0.076	6.314*	Supported

Note: *p<0.05



Remark: Dashed lines, not significant; solid lines, significant.
*p<0.05

Figure 2: The Results of Structural Model

In this study, we delved into the multifaceted landscape of logistics and supply chain organizations in Thailand, aiming to identify and comprehend the crucial factors that significantly influence innovation and organizational performance within this dynamic sector. Employing a Structural Equation Model (SEM) and testing several hypotheses, the research unfolded key insights into the intricate relationships among variables.

The results revealed compelling patterns and relationships, shedding light on the impact of Information and Communication Technology (ICT) use, entrepreneurial orientation, collective entrepreneurship, innovation, and organizational performance. The standardized path coefficients (β), standard errors (S.E.), and T-values were crucial indicators in assessing the significance and strength of these relationships, as of Table 6, and Figure 2.

The study found significant support for the influence of ICT use on entrepreneurial orientation (H1) and innovation (H2), with robust path coefficients of 0.264 and 0.642, respectively. This underscores the pivotal role of technology in shaping both the entrepreneurial mindset and fostering innovative practices within organizations.

However, the third hypothesis (H3) indicating the impact of ICT use on organizational performance did not receive support, with a path coefficient of 0.086 and a T-

value of 1.203. This unexpected result suggests a nuanced relationship between ICT use and overall organizational performance that requires further exploration.

Contrary to expectations, the study did not find significant support for the influence of entrepreneurial orientation on innovation (H4), with a path coefficient of 0.061 and a T-value of 1.266. This result prompts a reevaluation of the assumed link between entrepreneurial orientation and the generation of innovative ideas and practices.

In contrast, the hypothesis positing the influence of collective entrepreneurship on innovation (H5) received substantial support, with a path coefficient of 0.310 and a T-value of 5.255. This underscores the importance of collaborative efforts and collective entrepreneurial spirit in driving innovation within the logistics and supply chain context.

The final hypothesis (H6) established a significant and positive influence of innovation on organizational performance, supported by a path coefficient of 0.509 and a T-value of 6.314. This crucial finding emphasizes the strategic significance of fostering a culture of innovation for sustained organizational success in the dynamic sector under study.

5. Conclusions and Recommendation

5.1. Conclusion and Discussion

This research has delved into the intricate landscape of logistics and supply chain organizations in Thailand, aiming to unravel the key factors shaping innovation and organizational performance within this dynamic sector. The comprehensive investigation utilized a questionnaire distributed to 400 employees with a minimum of one-year experience in ten selected organizations. Employing a judicious combination of judgmental, convenience, and snowball sampling techniques, the study employed Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) to assess and validate the research model, subsequently conducting hypothesis testing.

The findings of this study provide nuanced insights into the relationships among Information and Communication Technology (ICT) use, entrepreneurial orientation, collective entrepreneurship, innovation, and organizational performance.

The results revealed a significant influence of ICT use on both entrepreneurial orientation and innovation. This underscores the transformative role of technology in shaping the entrepreneurial mindset and fostering innovative practices within the logistics and supply chain context, as

aligned with previous studies (Cardona et al., 2013; Koellinger, 2008; Tran et al., 2014; Yunis et al., 2017).

Interestingly, ICT use did not exhibit a significant influence on organizational performance. This unexpected finding prompts a deeper exploration into the complex and context-dependent nature of the relationship between technology adoption and overall organizational success. Yunis et al. (2017) acclaimed that the independent application of Information and Communication Technology (ICT) is insufficient to drive organizational performance or establish a sustainable competitive advantage unless ICT is strategically applied in an innovative manner.

Contrary to expectations, the study did not find a significant influence of entrepreneurial orientation on innovation, which is against the view of previous scholars (Brynjolfsson & Saunders, 2010; Melville et al., 2004; Yunis et al., 2017). This result challenges conventional assumptions and highlights the need for a nuanced understanding of how entrepreneurial mindsets translate into innovative practices within this specific industry.

In the similar finding of Makhdoom et al. (2019), this study demonstrated a substantial influence of collective entrepreneurship on innovation, emphasizing the importance of collaborative efforts and a collective entrepreneurial spirit in driving innovative practices within logistics and supply chain organizations.

Importantly, innovation emerged as a significant driver of organizational performance as affirmed by many researchers (Avermaete et al., 2003; Makhdoom et al., 2019; Salim & Sulaiman, 2011; Yunis et al., 2017). This underscores the strategic imperative for organizations in this sector to foster a culture that encourages and sustains innovative practices.

The research on logistics and supply chain organizations in Thailand highlights several significant policy and managerial implications. The study underscores the importance of strategically embracing Information and Communication Technology (ICT) for innovation, advocating for supportive policies and managerial investments. It suggests fostering an entrepreneurial orientation within the industry, recommending initiatives that encourage risk-taking and creativity. Additionally, the findings emphasize the role of collective entrepreneurship and collaboration, both of which could benefit from supportive policies and organizational efforts. Notably, innovation emerges as a key driver of organizational performance, prompting policymakers to incentivize innovative practices and organizations to prioritize a culture of continuous innovation. Lastly, the study underscores the importance of knowledge dissemination and collaboration, advocating for policies that promote research-sharing platforms and encouraging organizations to actively engage with research findings for ongoing industry advancement.

5.2. Recommendation

This research suggests that managers should invest Organizations should strategically integrate Information and Communication Technology (ICT) into their operations, emphasizing innovative applications that align with their specific goals and challenges. This involves leveraging ICT not just for its own sake but as a tool to enhance efficiency, collaboration, and overall business processes.

Fostering an entrepreneurial mindset among employees is crucial. Organizations should invest in training programs, workshops, and initiatives that cultivate a culture of creativity, risk-taking, and proactive problem-solving. This approach can translate entrepreneurial thinking into innovative actions that contribute to organizational success.

Promoting collective entrepreneurship and collaborative platforms is essential for fostering innovation. Organizations should encourage teamwork, cross-functional collaboration, and knowledge sharing. This collaborative approach harnesses the diverse expertise within the workforce, leading to more innovative solutions and practices.

Establishing a systematic approach to innovation is imperative. Organizations should create dedicated innovation teams or allocate resources specifically for exploring and implementing new ideas. This could involve setting up innovation labs, organizing regular ideation sessions, and incentivizing employees for contributing innovative solutions.

Leadership plays a pivotal role in promoting innovation. Leaders should adopt an adaptive and supportive leadership style, encouraging experimentation, learning from failures, and embracing change. A leadership team that values and champions innovation sets the tone for the entire organization.

Providing ongoing training and professional development opportunities related to emerging technologies and innovative practices is vital. This ensures that employees are equipped with the necessary skills to leverage ICT effectively and contribute to innovative initiatives within the organization.

Regularly benchmarking against industry best practices and learning from successful innovative organizations can provide valuable insights. Organizations should stay informed about technological trends, market dynamics, and successful innovation strategies to adapt and remain competitive.

Establishing feedback mechanisms that allow employees at all levels to contribute ideas, provide feedback, and participate in the innovation process is essential. Creating an inclusive environment where diverse perspectives are valued fosters a culture of continuous improvement and innovation.

Exploring strategic partnerships with technology providers, research institutions, and other industry players can open avenues for collaborative innovation. Such partnerships can bring in external perspectives, resources, and expertise, enhancing the organization's capacity for innovative endeavors.

Developing and tracking key performance indicators (KPIs) related to innovation is crucial. Organizations should establish metrics that measure the success of innovation initiatives, employee engagement in innovative activities, and the impact of innovation on organizational performance.

By implementing these recommendations, organizations can create an environment conducive to innovation, ensuring that ICT is not just a tool but a catalyst for continuous improvement and sustainable competitive advantage.

5.3. Limitation and Further Study

Several limitations are guided for the future study. First, the findings of this study are specific to the logistics and supply chain sector in Thailand. Future research should explore whether similar patterns emerge in different industries or regions. The contextual specificity of the current study necessitates caution when generalizing findings to diverse organizational settings.

Second, the study focused on a specific sample size and selected logistics and supply chain organizations in Thailand. Future studies could enhance generalizability by expanding the sample size and including a more diverse range of organizations, considering variations in size, industry, and geographical location.

Last, the study did not extensively explore external environmental factors that may influence the observed relationships. Future research could incorporate an analysis of external factors, such as economic conditions, regulatory changes, or global events, to better understand how these external forces interact with internal dynamics.

Addressing these limitations in future studies will contribute to a more comprehensive understanding of the complex relationships between Information and Communication Technology (ICT), entrepreneurial orientation, collective entrepreneurship, innovation, and organizational performance in diverse organizational contexts.

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