The Influence of Sustainable Warehouse Practices on Competitive Advantage of Distribution Centers in Nakhon Pathom Province

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Abstract

This research aimed to investigate the influence of sustainable warehouse practices on the competitive advantage of distribution centers in Nakhon Pathom Province. The objectives of the study were: (1) to examine the level of sustainable warehouse practices of distribution centers in Nakhon Pathom Province, (2) to examine the level of competitive advantage, and (3) to analyze the influence of sustainable warehouse practices on competitive advantage. This study employed a quantitative research approach, using a questionnaire as the data collection instrument. The sample consisted of 385 respondents, including executives, managers, supervisors, and operational staff involved in warehouse management and operations. The sample size was determined using the formula for an unknown population at a 95% confidence level. Data were analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation, as well as inferential statistics, namely Pearson's correlation coefficient and multiple regression analysis.

The findings revealed that the overall level of sustainable warehouse practices among distribution centers in Nakhon Pathom Province was high, and the level of competitive advantage was also high. All five dimensions of sustainable warehouse practices namely sustainable energy use, waste and packaging management, efficient warehouse operations, personnel and sustainability culture, and supply chain collaborations showed positive and statistically significant relationships with competitive advantage. Furthermore, the results of multiple regression analysis indicated that all five dimensions of sustainable warehouse practices had a positive influence on competitive advantage, with efficient warehouse operations identified as the most influential factor. The findings of this study provide practical and policy-oriented implications for distribution centers in developing sustainable warehouse practices to enhance and sustain their competitive advantage in the long term.

Keywords: Sustainable Warehouse Practices; Competitive Advantage; Distribution Centers

1. Introduction

1.1 Background and Significance of the Problem

The logistics and supply chain sector plays a vital role in economic development by supporting production activities and facilitating the distribution of goods. Warehouses and distribution centers serve as key nodes for storage, inventory management, and product distribution. However, traditional warehouse operations often create negative environmental

and social impacts, including high energy consumption, excessive packaging waste, inefficient resource use, and concerns regarding employee safety and welfare.

In response to these challenges, the concepts of Sustainable Development and Sustainable Logistics and Supply Chain Management have gained increasing attention. Organizations are increasingly adopting sustainable warehouse practices, such as efficient energy use, waste and packaging management, operational efficiency improvement, human resource development, and collaboration with supply chain partners, to balance economic performance with environmental and social responsibilities.

At the same time, intense business competition has compelled distribution centers to seek competitive advantage through cost reduction, service quality improvement, operational efficiency, and enhanced corporate image. Although existing theories suggest that effective resource management and efficient operations can generate sustainable competitive advantage, empirical evidence on the impact of sustainable warehouse practices on competitive performance in Thailand remains limited.

Nakhon Pathom Province is a strategically important logistics hub connecting Bangkok with western Thailand and hosting numerous distribution centers. Nevertheless, comprehensive empirical studies examining the influence of sustainable warehouse practices on competitive advantage in this area are still scarce.

Therefore, this research aims to examine the influence of sustainable warehouse practices on the competitive advantage of distribution centers in Nakhon Pathom Province. The findings are expected to contribute empirical evidence to the academic literature and provide practical insights for managers and policymakers in developing sustainability-oriented strategies to enhance long-term competitiveness.

1.2 Research Objective

1. To examine the level of sustainable warehouse practices of distribution centers in Nakhon Pathom Province.

2. To examine the level of competitive advantage of distribution centers in Nakhon Pathom Province.

3. To analyze the influence of sustainable warehouse practices on the competitive advantage of distribution centers in Nakhon Pathom Province.

1.3 Research Conceptual Framework

The underlying concept of this study is that **sustainable warehouse practices** influence the **competitive advantage** of distribution centers. The variables of the research are defined as follows

Independent Variables

X_1 Sustainable energy use practices

X_2 Waste and packaging management practices

X_3 Efficient warehouse operations practices

X_4 Personnel and sustainability-oriented organizational culture practices

X_5 Supply chain collaboration practices

Dependent Variable

Y Competitive advantage of distribution centers in Nakhon Pathom Province

In this study, sustainable warehouse practices in terms of energy use, waste and packaging management, operational efficiency, personnel and organizational culture, and supply chain collaboration are hypothesized to have an influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

1.4 Research Hypotheses

In accordance with the statistical methods employed in this study, the research hypotheses are formulated as follows:

H1: Overall sustainable warehouse practices have a positive relationship with the competitive advantage of distribution centers in Nakhon Pathom Province.

H2: Sustainable energy use practices have a positive influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

H3: Waste and packaging management practices have a positive influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

H4: Efficient warehouse operations practices have a positive influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

H5: Personnel and sustainability-oriented organizational culture practices have a positive influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

H6: Supply chain collaboration practices have a positive influence on the competitive advantage of distribution centers in Nakhon Pathom Province.

1.5 Expected Benefits of the Study

1. To provide empirical evidence regarding the level of sustainable warehouse practices and the level of competitive advantage of distribution centers in Nakhon Pathom Province, reflecting the current status of sustainability implementation in logistics operations.

2. To identify which dimensions of sustainable warehouse practices have the strongest relationships with and influences on competitive advantage, thereby enabling managers to prioritize investments and operational improvements more effectively.

3. To serve as policy-oriented and practical guidelines for distribution centers and logistics service providers in developing sustainable warehouse practices in order to achieve sustained competitive advantage.

4. To provide a database and conceptual framework for researchers and practitioners interested in further studies on warehouse sustainability and supply chain sustainability in other regions or industries.

2. Literature Review

2.1 Sustainable Development

Warehouses and distribution centers play a crucial role in logistics and supply chain operations; however, traditional warehouse activities often lead to high energy consumption, excessive waste, inefficient resource use, and social concerns. In response, the concepts of Sustainable Development and Sustainable Logistics have encouraged organizations to adopt

sustainable warehouse practices, such as energy efficiency, waste management, operational improvement, workforce development, and supply chain collaboration.

At the same time, increasing competition requires distribution centers to enhance their competitive advantage through cost efficiency, service quality, and operational effectiveness. Although sustainability-oriented practices are widely promoted, empirical evidence on their impact on competitive advantage in Thailand remains limited.

Nakhon Pathom Province is an important logistics hub with numerous distribution centers, yet studies examining the relationship between sustainable warehouse practices and competitive advantage in this context are scarce. Therefore, this study investigates the influence of sustainable warehouse practices on the competitive advantage of distribution centers in Nakhon Pathom Province, contributing both academic insights and practical guidance for sustainability-driven competitiveness.

2.2 Sustainable Logistics and Supply Chain Management

The concept of sustainable logistics and supply chain management represents an extension of traditional logistics management frameworks to encompass economic, social, and environmental impacts across the entire value chain, from raw material source and production processes to warehousing, distribution, and post-consumption management. The primary objective of this approach is to enhance operational efficiency while simultaneously promoting long-term environmental stewardship and social responsibility (Waiyawuththanapoom et al., 2025)

Chopra and Meindl (2016) explain that sustainable supply chain management requires the integration of decisions related to cost, service level, and environmental impact. Organizations can no longer focus solely on cost efficiency or delivery speed; instead, they must account for resource utilization, energy consumption, waste generation, and operational risks across the entire supply chain. This integrated perspective emphasizes that sustainability should be embedded within supply chain design rather than treated as a supplementary initiative implemented after operations have been established.

This view is further supported by Wararatchai and Chaitorn (2023), who argue that organizational leadership and customer loyalty play a critical role in enhancing supply chain performance. Their findings suggest that sustainability-oriented supply chain practices are more likely to be effectively implemented when supported by strong leadership and long-term relational commitment, thereby reinforcing the integration of sustainability into core operational and strategic decision-making processes.

Similarly, Christopher (2016) defines sustainable logistics as the management of the flow of goods, information, and resources in ways that minimize negative environmental impacts while creating value for customers and other stakeholders. This approach emphasizes process efficiency, waste reduction, energy efficiency, and collaboration among organizations within the supply chain. Christopher particularly underscores the role of warehouses and distribution centers as critical nodes that can simultaneously generate operational costs and sustainability-related value.

Synthesizing insights from both sources, sustainable logistics and supply chain management can be characterized as a balanced approach that seeks to harmonize economic efficiency, environmental impact reduction, and social responsibility through process design, technological adoption, human resource management, and collaboration among supply chain partners. Consequently, this concept provides an essential theoretical foundation for explaining

why sustainable warehouse practices such as energy management, waste reduction, operational efficiency, workforce development, and supply chain collaboration can contribute to the long-term competitive advantage of distribution centers.

2.3 Concepts and Theories Related to Sustainable Warehouse Practices

Sustainable warehouse practices refer to the application of sustainability principles to warehouse management and operations, with the aim of reducing environmental impacts, improving resource efficiency, and creating long-term economic value. This concept extends beyond cost reduction or operational speed alone, encompassing system design, energy management, waste control, workforce management, and collaboration with stakeholders throughout the supply chain.

Richards (2018) argues that modern warehouse management must move beyond traditional operational frameworks toward sustainable warehouse management by emphasizing efficient use of space, energy, and resources, as well as minimizing waste in storage and order fulfillment processes. Richards highlights that practices such as warehouse layout design, the adoption of energy-efficient equipment, the use of warehouse management systems (WMS), and workforce skill development are critical factors that enable warehouses to reduce operating costs while simultaneously lowering environmental impacts. These practices align with the economic and environmental dimensions of sustainable warehousing (Phunlarp, Thriyawanich, & Yimcharoenpornsakul, 2025)

In addition, Frazelle (2002) introduces the concept of World-Class Warehousing, which views the warehouse as a strategic hub within the supply chain rather than merely a storage facility. This perspective emphasizes the integration of warehouse processes to achieve high performance through performance measurement, continuous process improvement, and the use of technology to support managerial decision-making. Frazelle further explains that workforce development, a performance-oriented organizational culture, and collaboration with supply chain partners are essential components that enable warehouses to create value and sustain competitive capability over time.

Based on the literature review, sustainable warehouse practices can be conceptualized as a system-oriented set of management approaches encompassing energy management, waste and resource management, operational efficiency, workforce development, and supply chain collaboration. These concepts form the theoretical foundation for the independent variables in this study: sustainable energy use practices, waste and packaging management practices, efficient warehouse operations practices, personnel and sustainability-oriented organizational culture practices, and supply chain collaboration practices. Collectively, these practices provide a pathway for distribution centers to achieve long-term competitive advantage.

2.4 Concepts and Theories Related to Competitive Advantage

Competitive advantage is a central concept in the field of strategic management, used to explain an organization’s ability to achieve superior performance compared to its competitors within the same industry. This superiority may be reflected in various dimensions, including cost efficiency, quality, service performance, flexibility, and corporate image. The concept has been widely applied to explain why certain organizations are able to sustain their competitive position over the long term.

Porter (1985) argues that competitive advantage arises from an organization’s ability to create greater value for customers than its competitors. He identifies two primary generic

strategies for achieving competitive advantage: cost leadership and differentiation. These strategies can be accomplished through the effective management of activities along the value chain. Porter's framework highlights logistics and warehousing as key supporting activities that play a significant role in cost reduction and value creation, thereby directly contributing to an organization's competitive advantage.

From another perspective, Barney (1991) introduces the Resource-Based View (RBV), which explains competitive advantage as the outcome of possessing and effectively utilizing organizational resources and capabilities that are valuable, rare, inimitable, and non-substitutable (VRIN framework). Under this perspective, operational processes, employee knowledge, organizational culture, and efficient management systems are regarded as strategic resources capable of generating sustainable competitive advantage. The RBV thus provides a theoretical explanation for how sustainable warehouse practices, when embedded within organizational processes and culture, can be developed into core competencies that are difficult for competitors to replicate.

Subsequently, Barney and Hesterly (2015) extend the concept of competitive advantage by linking it to long-term organizational performance. They emphasize that firms can sustain competitive advantage only when they continuously adapt their strategies to changing environments and invest in the ongoing development of resources and capabilities. This view suggests that competitive advantage is not a static outcome, but rather a dynamic process, which is particularly relevant in the contemporary logistics and warehousing context characterized by increasing cost pressures, technological change, and sustainability requirements.

Based on the literature review, competitive advantage in this study is conceptualized as the result of integrating cost-oriented strategies, value creation, and internal organizational resources. In particular, the adoption of sustainable warehouse practices serves as a mechanism for improving operational efficiency, reducing costs, creating differentiation, and enhancing corporate image. These outcomes contribute to the long-term competitive capability of distribution centers.

2.5 Related Studies

Tan, A., Wahab, S. N., and Gerth, F. (2025) conducted a study entitled Cost-Effectiveness of Implementing Sustainable Practices and Technologies in Warehousing Operations, which examined the economic feasibility and competitive impacts of adopting sustainable warehouse practices in organizations. The objective of the study was to evaluate the cost-effectiveness and benefits derived from implementing sustainable practices and green technologies in warehousing, as well as their effects on long-term competitive advantage. The study employed an online survey and adopted a mixed-methods research approach, combining quantitative and qualitative data collected from professionals with experience in warehouse management to assess perceptions and outcomes of sustainability adoption. The findings revealed that the implementation of sustainable practices and green technologies significantly reduced operating costs and improved corporate image, thereby supporting the creation of long-term competitive advantage. Although initial investment costs were relatively high, the long-term returns were found to be more economically beneficial.

Pongpreecha, A., and Donsomjitr, P. (2024) investigated Key Performance Indicators for Sustainable Warehouse Management: A Case Study of Third-Party Logistics in Chonburi,

focusing on the development of key performance indicators (KPIs) for assessing sustainability in warehouse management within logistics service providers. The objective of the study was to develop a set of KPIs for sustainable warehouse management based on economic, social, and environmental dimensions among warehouse service providers in Chonburi Province. The research methodology involved a literature review and structured interviews with warehouse operators and sustainability experts, followed by the application of the Analytic Hierarchy Process (AHP) to determine the relative importance of the indicators. The results indicated that economic indicators were assigned the highest priority compared to social and environmental dimensions. The developed KPIs were found to be useful for both regulatory oversight and the improvement of sustainable warehouse practices.

Munkongtum, C. (2025) conducted a study entitled The Relationship between Green Warehouse Management Strategies and Operational Performance in Thai Industries, which examined sustainable warehouse policies and operational performance outcomes. The objective was to assess the level of green warehouse strategy implementation in Thai industries and analyze its relationship with operational performance. The study employed a mixed-methods approach, consisting of a quantitative survey of 395 warehouse managers and qualitative in-depth interviews with industry experts. Data were analyzed using correlation and multiple regression analyses. The findings demonstrated that all five dimensions of green warehouse management strategies exhibited a strong positive relationship with operational performance across all dimensions and contributed to cost reduction and improved resource utilization efficiency.

Martins, V. W. B. (2019) conducted a study entitled Sustainable Practices in Logistics Systems: An Overview of Applications in Brazilian Companies, which provided an overview of the adoption of sustainable practices in logistics systems, including warehousing. The objective of the study was to present an overview of how companies in Brazil have applied sustainable practices in logistics activities. The research methodology involved content analysis of relevant reports and documents to extract sustainable practice approaches within logistics operations. The results indicated that various sustainable practices had been developed and implemented in logistics activities; however, the level of adoption remained relatively low, with most initiatives focusing primarily on reducing emissions and energy consumption. The study suggested that these practices could serve as a foundation for further research on sustainable warehousing.

Cannava, L. (2024) examined Green Warehousing Practices: Assessing the Impact of Photovoltaic (PV) Integration in Logistics Facilities, which focused on the effects of sustainable energy use in warehouse operations. The objective of the study was to evaluate the impact of integrating photovoltaic (PV) systems into warehouses on reducing environmental impacts and improving operational efficiency. The study employed a simulation-based methodology to compare warehouse operations using PV systems with baseline scenarios. The findings showed that the integration of PV systems significantly reduced reliance on non-renewable energy sources and lowered energy costs, while also enhancing system sustainability. These outcomes indirectly contributed to improved corporate image and competitive advantage.

Table 1: Synthesis of Research Variables Derived from the Literature Review

Research Variables	Authors (Year)
X_1 Sustainable Energy Use Practices	World Commission on Environment and Development (1987); United Nations (2015); Elkington (1998); Christopher (2016); Richards (2018); Tan et al. (2025); Cannava (2024)
X_2 Waste and Packaging Management Practices	Elkington (1998); United Nations (2015); Chopra & Meindl (2016); Christopher (2016); Martins (2019); Pongpreecha & Donsomjitr (2024); Munkongtum (2025)
X_3 Efficient Warehouse Operations Practices	Chopra & Meindl (2016); Christopher (2016); Frazelle (2002); Richards (2018); Tan et al. (2025); Munkongtum (2025)
X_4 Personnel and Sustainability-Oriented Organizational Culture Practices	Elkington (1998); Christopher (2016); Frazelle (2002); Richards (2018); Munkongtum (2025)
X_5 Supply Chain Collaboration Practices	United Nations (2015); Chopra & Meindl (2016); Christopher (2016); Martins (2019); Pongpreecha & Donsomjitr (2024)
Y Competitive Advantage of Distribution Centers	Porter (1985); Barney (1991); Barney & Hesterly (2015); Tan et al. (2025); Cannava (2024)

3. Methodology

3.1 Research Design

This study employed a quantitative research approach using a survey research design. The objectives of the study were: (1) to examine the level of sustainable warehouse practices of distribution centers in Nakhon Pathom Province; (2) to examine the level of competitive advantage of distribution centers in Nakhon Pathom Province; and (3) to analyze the influence of sustainable warehouse practices on the competitive advantage of distribution centers.

3.2 Population and Sample

The population of this study consisted of executives, managers, supervisors, and personnel who were involved in the management and/or operational activities of warehouses in distribution centers located in Nakhon Pathom Province.

The sample size was determined using Cochran's (1977) formula for an unknown population size, with a 95% confidence level, a margin of error (e) of 0.05, and a population proportion (p) of 0.50 to ensure the maximum required sample size. The calculation indicated that the minimum appropriate sample size was 385 respondents.

3.3 Research Instrument

The research instrument used in this study was a structured questionnaire, which was divided into three main sections:

Section 1 General information of the respondents, including position, work experience, and type of business or characteristics of the distribution center.

Section 2 Independent variables sustainable warehouse practices comprising five dimensions:

X_1: Sustainable energy use practices

X_2: Waste and packaging management practices

X_3: Efficient warehouse operations practices

X_4: Personnel and sustainability-oriented organizational culture practices

X_5: Supply chain collaboration practices

Section 3 Dependent variable (Y): Competitive advantage of distribution centers.

All questionnaire items were measured using a five-point Likert scale.

This study applied a five-point Likert scale to assess respondents' perceptions and levels of practice. The interpretation of mean scores followed widely accepted descriptive statistical guidelines in social science research, using mean values and standard deviations to explain the level of opinions and practices (Likert, 1932; Best & Kahn, 2006; Boonchom Srisawad, 2017)

3.4 Instrument Validation and Reliability

Content validity was assessed by a panel of experts who reviewed the questionnaire items to ensure consistency with the research objectives and theoretical framework. The Index of Item- Objective Congruence (IOC) was calculated for each item, and all items met the acceptance criteria established by the institution.

Reliability was examined through a pilot test conducted with a group of respondents who possessed characteristics similar to those of the target population. The internal consistency of the questionnaire was evaluated using Cronbach's alpha coefficient. The results indicated that all items demonstrated acceptable reliability, with Cronbach's alpha values of 0.70 or higher, which is considered satisfactory for social science research.

3.5 Data Collection

Data was collected from the sample group working in distribution centers located in Nakhon Pathom Province. The questionnaire was distributed **online**, accompanied by an explanation of the research objectives and conditions for participation. Data collection was carried out until the required number of completed questionnaires, as determined by the sample size calculation, was obtained.

3.6 Data Analysis and Statistical Techniques

Data analysis was conducted in two stages

Descriptive Statistics were used to describe the characteristics of the data and the levels of the research variables, including:

Frequency and percentage to describe respondents' general information;

Mean and standard deviation to interpret the levels of the independent variables (X_1–X_5) and the dependent variable (Y).

Inferential Statistics were employed to test the research hypotheses:

1. Pearson's correlation coefficient was used to examine the relationships between each dimension of sustainable warehouse practices (X_1–X_5) and competitive advantage (Y).

2. Multiple regression analysis was applied to analyze the influence of the independent variables (X_1–X_5) on the dependent variable (Y). The regression model can be expressed as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Statistical significance was determined at the 0.05 level.

3.7 Research Period

The research was conducted from August 2025 to December 2025, covering the following key stages (1) literature review and instrument development; (2) instrument validation and pilot testing; (3) field data collection; and (4) data analysis and conclusion.

4. Results

4.1 General Information of Respondents

The respondents in this study consisted of executives, managers, supervisors, and personnel involved in the management and operational activities of warehouses in distribution centers located in Nakhon Pathom Province. A total of 385 respondents participated in the survey. The analysis of respondents' general information can be summarized as follows.

The majority of respondents were male, totaling 232 individuals (60.26%), while 153 respondents (39.74%) were female. In terms of age, most respondents were in the 31–40 years age group, accounting for 157 individuals (40.78%), followed by those aged 41–50 years, totaling 112 individuals (29.09%), and those under 30 years of age, totaling 69 individuals (17.92%), respectively.

Regarding job position, the largest proportion of respondents were warehouse supervisors or operations leaders, with 161 individuals (41.82%). This was followed by warehouse managers or assistant managers, totaling 124 individuals (32.21%), and senior executives or business owners, totaling 100 individuals (25.97%).

With respect to work experience in warehouse operations, most respondents reported 5–10 years of experience, accounting for 148 individuals (38.44%). This was followed by those with more than 10 years of experience, totaling 121 individuals (31.43%), and those with less than 5 years of experience, totaling 116 individuals (30.13%).

Overall, these findings indicate that the sample group possessed substantial experience and direct involvement in warehouse management and operations. Therefore, the respondents were considered appropriate and well-qualified to provide reliable information for the purposes of this research.

4. 2 Results of the Analysis of the Level of Sustainable Warehouse Practices of Distribution Centers in Nakhon Pathom Province

Table 2: Level of Sustainable Warehouse Practices of Distribution Centers in Nakhon Pathom Province

Sustainable Warehouse Practices	Mean ($\bar{x}$)	Standard Deviation (S.D.)	Interpretation
X_1 Sustainable Energy Use Practices	3.86	0.61	High
X_2 Waste and Packaging Management Practices	3.79	0.60	High
X_3 Efficient Warehouse Operations Practices	4.02	0.54	High
X_4 Personnel and Sustainability-Oriented Organizational Culture Practices	3.94	0.58	High
X_5 Supply Chain Collaboration Practices	3.72	0.63	High
Overall Sustainable Warehouse Practices	**3.87**	**0.56**	**High**

From Table 2, the overall level of sustainable warehouse practices among distribution centers in Nakhon Pathom Province was at a high level. Among the five dimensions, efficient

warehouse operations practices (X_3) recorded the highest mean score, indicating strong emphasis on operational efficiency in warehouse management. In contrast, supply chain collaboration practices (X_5) exhibited the lowest mean score relative to the other dimensions, although it remained at a high level overall.

4. 3 Results of the Analysis of the Relationship between Sustainable Warehouse Practices and Competitive Advantage

Table 3: Pearson' s Correlation Coefficients between Independent Variables and the Dependent Variable

Variables	Y Competitive Advantage
X_1 Sustainable Energy Use Practices	0.52*
X_2 Waste and Packaging Management Practices	0.48*
X_3 Efficient Warehouse Operations Practices	0.63*
X_4 Personnel and Sustainability-Oriented Organizational Culture Practices	0.58*
X_5 Supply Chain Collaboration Practices	0.46*

Statistically significant at the 0.05 level

As shown in Table 3, all dimensions of sustainable warehouse practices exhibited a positive and statistically significant relationship with the competitive advantage of distribution centers in Nakhon Pathom Province at the 0. 05 significance level. Among the independent variables, efficient warehouse operations practices (X_3) demonstrated the strongest correlation with competitive advantage, indicating that improvements in operational efficiency are most closely associated with enhanced competitive performance among distribution centers.

4. 4 Results of the Analysis of the Influence of Sustainable Warehouse Practices on Competitive Advantage

Table 4: Effects of Sustainable Warehouse Practices on Competitive Advantage

Independent Variables	B	S.E.	β	t	Sig.
Constant	0.87	0.18	–	4.83	0.000
X_1 Sustainable Energy Use Practices	0.21	0.05	0.22	4.20	0.000
X_2 Waste and Packaging Management Practices	0.17	0.05	0.18	3.40	0.001
X_3 Efficient Warehouse Operations Practices	0.29	0.06	0.31	4.83	0.000
X_4 Personnel and Sustainability- Oriented Organizational Culture Practices	0.24	0.05	0.26	4.80	0.000
X_5 Supply Chain Collaboration Practices	0.15	0.05	0.16	3.00	0.003

$R = 0.71$, $R^2 = 0.50$, Adjusted $R^2 = 0.49$, $F = 75.62$, Sig. = 0.000

Based on Table 4, all five dimensions of sustainable warehouse practices exerted a positive and statistically significant influence on the competitive advantage of distribution centers in Nakhon Pathom Province at the 0. 05 significance level. Among the independent variables, efficient warehouse operations practices (X_3) demonstrated the strongest influence on competitive advantage, followed by personnel and sustainability- oriented organizational culture practices (X_4).

The results indicate that sustainable warehouse practices collectively explain 50% of the variance in competitive advantage ($R^2 = 0.50$), suggesting that these practices play a substantial role in enhancing the competitive performance of distribution centers.

The multiple regression equation can be expressed as follows:

$$Y = 0.87 + 0.21X_1 + 0.17X_2 + 0.29X_3 + 0.24X_4 + 0.15X_5$$

where
Y= Competitive advantage of distribution centers,
X_1= Sustainable energy use practices,
X_2= Waste and packaging management practices,
X_3= Efficient warehouse operations practices,
X_4= Personnel and sustainability-oriented organizational culture practices, and
X_5= Supply chain collaboration practices.

Table 5: Summary of Research Hypothesis Testing Results

Hypothesis	Hypothesis Description	Statistical Method	Result	Significance Level
H1	Overall sustainable warehouse practices are positively related to competitive advantage.	Pearson' s Correlation	Supported	0.05
H2	Sustainable energy use practices have a positive influence on competitive advantage.	Multiple Regression	Supported	0.05
H3	Waste and packaging management practices have a positive influence on competitive advantage.	Multiple Regression	Supported	0.05
H4	Efficient warehouse operations practices have a positive influence on competitive advantage.	Multiple Regression	Supported	0.05
H5	Personnel and sustainability- oriented organizational culture practices have a positive influence on competitive advantage.	Multiple Regression	Supported	0.05
H6	Supply chain collaboration practices have a positive influence on competitive advantage.	Multiple Regression	Supported	0.05

5. Conclusion

5.1 Summary of Research Findings

The study entitled The Influence of Sustainable Warehouse Practices on the Competitive Advantage of Distribution Centers in Nakhon Pathom Province aimed to: (1) examine the level of sustainable warehouse practices; (2) examine the level of competitive advantage; and (3) analyze the influence of sustainable warehouse practices on competitive advantage. The research employed a quantitative approach using data collected from a sample of 385 respondents. The main findings can be summarized as follows:

1. Distribution centers in Nakhon Pathom Province exhibited an overall high level of sustainable warehouse practices, particularly in the areas of efficient warehouse operations and personnel and sustainability-oriented organizational culture.

2. All dimensions of sustainable warehouse practices demonstrated a positive and statistically significant relationship with competitive advantage.

3. All five dimensions of sustainable warehouse practices namely sustainable energy use, waste and packaging management, efficient warehouse operations, personnel and sustainability-oriented organizational culture, and supply chain collaboration had a positive and statistically significant influence on the competitive advantage of distribution centers in

Nakhon Pathom Province. Among these factors, efficient warehouse operations practices exerted the strongest influence.

5.2 Discussion of Findings

The finding that sustainable warehouse practices contribute to competitive advantage is consistent with the concept of sustainable development as articulated in *Our Common Future* by the World Commission on Environment and Development (WCED, 1987), which emphasizes that development decisions that consider long-term impacts on resources, the environment, and society can lead to long-term economic stability.

In the context of distribution centers, practices related to energy management, waste reduction, and human resource development reflect the application of sustainable development principles at the organizational level. The results of this study indicate that sustainability-oriented operations do not merely represent additional costs, but instead enhance long-term competitive capability.

Furthermore, the findings align with the 2030 Agenda for Sustainable Development (United Nations, 2015), which emphasizes the integration of economic, social, and environmental dimensions. Distribution centers that adopt sustainable practices are able to create economic value while simultaneously fulfilling social and environmental responsibilities.

The positive influence of sustainable warehouse practices on competitive advantage also supports Elkington's (1998) Triple Bottom Line (TBL) framework, which evaluates organizational success across three dimensions: People, Planet, and Profit. In this study, personnel and sustainability-oriented organizational culture represent the *People* dimension; energy use and waste management reflect the *Planet* dimension; and competitive advantage corresponds to the *Profit* dimension. The results clearly demonstrate the systemic linkage proposed by the TBL framework, indicating that investments in environmental and social initiatives can be transformed into tangible economic and competitive outcomes in the distribution center context.

The finding that efficient warehouse operations practices exerted the strongest influence on competitive advantage is consistent with the arguments of Chopra and Meindl (2016), who emphasize that sustainability should be embedded in supply chain design and operational processes rather than treated as a supplementary activity. Similarly, Christopher (2016) asserts that logistics systems that minimize waste, optimize resource utilization, and deliver customer value are better positioned to achieve sustainable competitiveness. These perspectives align closely with the empirical results of this study, which highlight operational efficiency as a key driver of competitive advantage.

The findings also support Richards' (2018) concept of modern warehouse management, which advocates a systems-based approach integrating energy efficiency, technology adoption, resource management, and workforce development. In addition, Frazelle's (2002) World-Class Warehousing concept, which views the warehouse as a strategic hub within the supply chain, helps explain why personnel and sustainability-oriented organizational culture, as well as supply chain collaboration, play important roles in enhancing competitive advantage.

Moreover, the results are consistent with Porter's (1985) theory of competitive advantage, which posits that effective management of value chain activities enables organizations to

reduce costs and achieve differentiation. Sustainable warehouse practices improve efficiency, reliability, and service quality, thereby strengthening both cost leadership and differentiation strategies.

At the same time, the findings strongly align with the Resource-Based View (RBV) proposed by Barney (1991) and further developed by Barney and Hesterly (2015). According to RBV, organizational processes, employee knowledge, organizational culture, and embedded management systems constitute strategic resources that are valuable, rare, and difficult to imitate. Sustainable warehouse practices, as examined in this study, can therefore be viewed as core organizational capabilities that enable distribution centers to sustain competitive advantage over the long term.

In summary, sustainable warehouse practices function not merely as operational improvements, but as strategic capabilities that strengthen the long-term competitive position of distribution centers.

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