THE IMPACT OF EXTERNAL SUPPLY CHAIN AND SUSTAINABLE COMPETITIVE ADVANTAGE ON THE PRODUCT INNOVATION PERFORMANCE: THE MODERATING ROLES OF INNOVATION TYPE

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This study delves into the intricate interplay between external supply chain dynamics, sustainable competitive advantage, innovation types, and product innovation performance. Through a comprehensive exploration, this research seeks to shed light on the relationships and their implications for organizations. The conceptual framework was constructed by introducing demographic variables such as position, company type, capitalization, etc. The minimum acceptable sample size for this study was calculated to be 384 and 520 valid questionnaires were distributed and returned to the companies in different industries through stratified sampling method, and hypotheses were formulated. Through related research, it was concluded that there is a strong positive relationship between the effectiveness of the external supply chain and the product innovation performance of an organization, there is a significant positive relationship between sustainable competitive advantage and product innovation performance, and innovation type does not have a significant moderating effect on the relationship between the external supply chain and product innovation performance. This study lays the groundwork for future research to explore deeper nuances in external supply chains, sustainable competitive advantage, and innovation types to enrich the collective knowledge of innovation and supply chain management.
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Introduction

The process of globalization has ushered in a transformative era for the economies, politics, and cultures of nations worldwide. This phenomenon has given rise to distinct developmental traits and a dynamic, competitive trend in business. This altered landscape transcends conventional spatial and temporal confines, compelling enterprises to ascertain their unique strategic advantages. This imperative facilitates the continuous attainment of competitive edges within the realm of business competition. Within this paradigm, two pivotal drivers of development – external supply chain (ESC) and sustainable competitive advantage (SCA) – have emerged as potent influencers, catalyzing enhancements in product performance. These factors intricately mold the dynamic journey of product formation, subtly yet profoundly influencing both product efficacy and the competitive prowess of organizations.

The efficacy of product innovation performance (PIP) serves as a cornerstone of organizational triumph, affording firms the capacity to devise and dispense novel, enhanced products in response to shifting consumer demands. Across the passage of time, scholars have delved into the myriad dimensions of PIP, peeling back its multifaceted nature and unveiling the pivotal determinants that sway its outcomes.

The epoch marked by the advent of the New Crown pandemic and the ensuing post-pandemic era has left an indelible mark on the landscape of product innovation performance. The outbreak of pandemics has caused ripples through industries, markets, and consumer behaviors, prompting a critical reassessment of orthodox metrics for innovation and performance evaluation. To navigate this terrain, it is imperative for organizations to gauge the pulse of evolving consumer needs and preferences within this "new normal," thus aligning their product innovation endeavors to ensure enduring customer gratification and allegiance.

The dimensions of product innovation performance proffer an invaluable font of insights and feedback for organizational learning and iterative enhancement. This introspective process enables organizations to pinpoint their areas of prowess and potential shortfalls within the innovation trajectory, thereby enabling strategic adjustments for heightened performance. The recognition of the intricate interplay between these dimensions and the identification of additional factors that wield influence over product innovation performance become pivotal for adept management of innovation endeavors.

In the post-COVID-19 epoch, organizations have discerned the strategic significance of robust and adaptable supply chains. Amidst the quest to navigate uncertainty and ensure seamless business operations, the nexus between external supply chains and sustainable competitive advantage assumes enhanced prominence. Empirical studies have showcased that organizations endowed with robust external supply chain networks and strategic collaborations are better poised to weather disruptions, navigate demand fluctuations, and mitigate risks. This, in turn, positions them to sustain competitive advantage within the marketplace.

Concomitantly, the post-New Crown Pneumonia epoch underscores the cardinal import of fostering employee attachment, commitment, and loyalty as drivers of innovation.
Organizations that place a premium on employee well-being, safety, and job security are poised to cultivate heightened attachment and commitment among their workforce. The pandemic's exigencies illuminate the imperative of workforce retention; high attrition rates can impede the seamless transfer of knowledge, collaboration, and the continuum of innovation efforts. Employees who feel secure and esteemed are likely to exhibit steadfast allegiance to the organization, thereby bolstering product innovation performance.

Notably, China has burgeoned into a global epicenter of manufacturing, occupying a pivotal role within the global supply chain. A cogent grasp of the interplay between external supply chains, sustainable competitive advantage, and product innovation performance could furnish Chinese enterprises with transformative insights to amplify their competitive stance on the international stage. By delineating the determinants steering product innovation performance, Chinese firms can devise strategic roadmaps harnessing the potency of supply chain relationships and sustainable competitive advantage to propel innovation and secure competitive differentiation. The insights gleaned can proffer invaluable guidance to Chinese policymakers and enterprises, shaping the contour of innovation strategies and policies that mirror China's unique innovation landscape and industrial competitive strengths. This orchestration has the potential to foster a more propitious innovation ecosystem and invigorate the global competitive standing of Chinese firms.

In totality, the findings of this study enrich the corpus of knowledge pertaining to the nexus of external supply chains and sustainable competitive advantage vis-à-vis product innovation performance. This contribution gains special salience within the context of China. The study's elucidation of these intricate relationships, underscored by evidence-based insights, stands to empower Chinese entities, policymakers, and industry practitioners, enabling astute decisions that elevate product innovation performance, augment competitive positioning, and contribute to the overarching tapestry of China's economic maturation and global competitive potency.

Research objectives

The main objective of this study is to examine the impact of external supply chains and sustainable competitive advantage on product innovation performance and to consider the moderating role of innovation type. This study aims to achieve the following specific objectives.

Objective 1: Assess the relationship between external supply chains and product innovation performance: The first objective of this study is to examine the direct relationship between external supply chains and product innovation performance. By analyzing empirical data and utilizing appropriate statistical techniques, this objective aims to provide insights into how external supply chains affect product innovation performance.

Objective 2: Examine the relationship between sustainable competitive advantage and product innovation performance: The second objective is to explore the direct relationship between sustainable competitive advantage and product innovation performance. Through empirical analysis, this objective aims to reveal the impact of sustainable competitive advantage on an organization's ability to innovate and introduce new products to the market.

Objective 3: Investigate the moderating effect of innovation types on the relationship between external supply chain and product innovation performance: The third objective of the study is to explore how different types of innovation (incremental, radical, and
disruptive) moderate the relationship between external supply chains and product innovation performance. This objective aims to understand how the impact of the external supply chain varies according to the nature and characteristics of the innovation being pursued.

Objective 4: Explore the moderating role of innovation type on the relationship between sustainable competitive advantage and product innovation performance: Fourth, investigate how innovation type moderates the relationship between sustainable competitive advantage and product innovation performance. By considering different types of innovations, this objective aims to reveal how the impact of sustainable competitive advantage on product innovation performance varies based on a particular innovation context. Practical insights are provided for organizations and contribute to the existing body of knowledge.

Literature review

The primary purpose of the literature review is to critically analyze and integrate relevant academic works to contextualize the current research and identify gaps in the existing knowledge.

The concept of innovation was first introduced by the economist Schumpeter and summarized as the ability to create economic value from new ideas. Since then, there has been a great deal of discussion of innovation by scholars in different subject areas. Innovation has many manifestations, which can be a new product or service, a new production method, a new market, a new organizational structure, etc. And the most studied and widely researched in the former academic world is nothing more than product innovation, also known as new product development.

Lamming et al. (2017) conducted a study that examined the relationship between supply chain responsiveness and product innovation performance. Their research emphasized the importance of flexibility and agility within the supply chain to adapt to changing market conditions and technological advancements. Organizations with responsive supply chains were better positioned to seize opportunities for innovation and quickly respond to emerging customer needs.

Saheem et al. (2020) investigated the influence of supply chain sustainability practices on product innovation performance. Their research highlighted that sustainable supply chain practices, such as responsible sourcing, eco-friendly manufacturing, and green logistics, positively impacted innovation capabilities. Sustainability-oriented supply chains not only inspired creativity in product design but also improved the firm's reputation and brand image, leading to a competitive advantage in the market.

Innovation has a profound impact on organizational performance. By introducing new products, services, or processes, organizations can gain a competitive edge, expand their market share, and achieve higher profitability (Damanpour, 1991). The type of innovation pursued also influences performance; for instance, radical innovations can lead to significant breakthroughs, while incremental innovations may lead to steady improvements in efficiency and cost-effectiveness (Ahuja & Lampert, 2001).

The relationships between external supply chain, sustainable competitive advantage, innovation, and product innovation performance significantly influence organizational performance. By integrating supply chain activities and enhancing collaboration with
suppliers and partners, organizations can streamline their operations, reduce costs, and respond more effectively to market demands, ultimately improving their overall performance.

Sustainable competitive advantage is a key driver of organizational performance. Organizations that possess unique resources and capabilities can differentiate themselves from competitors, attract customers, and maintain higher profitability over time (Barney, 1991). Moreover, integrating sustainability into a firm's competitive advantage can lead to improved financial performance and enhance the firm's reputation in the market (Eccles & Krzus, 2010).

Sustainable competitive advantage is derived from the concept of competitive advantage, reflecting the pursuit of enterprises to maintain their competitive advantage and posture. Different theoretical backgrounds have given different connotations to sustainable competitive advantage. From the perspective of competitive strategy, the core framework for firms to formulate strategies is to utilize their strengths to defuse threats while avoiding or compensating for weaknesses. This allows firms to construct sustainable competitive advantages in order to achieve long-term above-average performance (Porter, 1985).

Porter (1985) defined sustainable competitive advantage as having long-term profitability and above-average long-term performance. In order to perpetuate sustainable competitive advantage, firms must provide a "moving target" for their competitors through reinvestment to continuously improve their competitive position and maintain barriers to imitation (Porter, 1985).

The literature review revealed a significant positive relationship between external supply chain practices and product innovation performance. Collaborating with external partners, suppliers, and customers can lead to enhanced knowledge sharing, access to new technologies, and improved responsiveness to market demands, all of which contribute to better product innovation outcomes (Mudambi & Puck, 2021).

Supply chain integration has been identified as a crucial factor in fostering innovation capabilities within organizations (Narasimhan et al., 2016).

Methodology

For this study, a quantitative research design will be employed to investigate the impact of external supply chain practices and sustainable competitive advantage on product innovation performance, while also considering the moderating role of innovation types. Quantitative research is well-suited for this study as it allows for the collection and analysis of numerical data, enabling researchers to establish empirical relationships between variables and test hypotheses rigorously (Creswell, 2014).

External supply chain practices will be measured using a multi-dimensional scale adapted from Zhang & Wu (2016). The scale includes items related to supplier collaboration, customer integration, and supply chain responsiveness. Participants will rate the extent to which their organization engages in these practices on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate a higher level of external supply chain collaboration and integration.

To measure sustainable competitive advantage, a scale based on Barney's (1991) resource-based view of the firm will be used. This scale assesses the organization's valuable, rare, inimitable, and non-substitutable resources and capabilities. Participants will rate their
organization's resources and capabilities on a Likert-type scale ranging from 1 (not valuable) to 5 (highly valuable). Higher scores indicate a stronger sustainable competitive advantage.

Product innovation performance will be measured using a scale adapted from Saheem et al. (2020). The scale includes items related to the number of new products launched, the market success of new products, and the impact of new products on the organization's competitiveness. Participants will rate their organization's product innovation performance on a Likert-type scale ranging from 1 (poor) to 5 (excellent). Higher scores indicate higher product innovation performance.

Innovation type will be assessed using a scale adapted from Damanpour & Aravind (2012), which categorizes innovation into incremental, radical, and disruptive types. Participants will indicate the type of innovations their organization has undertaken, and each type will be assigned a numerical value (e.g., 1 for incremental, 2 for radical, and 3 for disruptive).

**Theoretical Implications**

a. Integration of Innovation Theories: This study integrates concepts from the resource-based view, external resource integration theory, and innovation theory to explain the relationships between external supply chain, sustainable competitive advantage, and product innovation performance. By doing so, it contributes to the theoretical understanding of how organizations can leverage external resources and sustainable advantages to drive innovation outcomes.

b. Moderation Effects: The study highlights the importance of considering innovation type as a moderator in the relationships between external supply chain, sustainable competitive advantage, and product innovation performance. This finding underscores the need for a nuanced approach to innovation management, as the impact of external resources and sustainable advantages can vary depending on the nature of innovation pursued.

**Practical Implications**

a. Enhancing Innovation Strategies: Organizations can use the findings to develop tailored innovation strategies that align with the specific innovation types pursued. For instance, for disruptive innovations, a more extensive and dynamic external supply chain network may be required, whereas for incremental innovations, a focused and stable supply chain might be more appropriate.

b. Leveraging Sustainable Competitive Advantage: The study highlights the importance of sustainable competitive advantages in driving product innovation performance. Organizations should focus on identifying and nurturing their unique resources and capabilities to sustain a competitive edge in the marketplace and foster innovation.

**Results**

In the regression analysis of the effect of the external supply chain on product innovation performance, there is an adjusted R-squared of 0.894 as can be seen in the model summary. The external supply chain (independent variable) explains 89.4% of the variance in product innovation performance (dependent variable). In the ANOVA test, the F-value is
and the significance p-value is .000b less than 0.01, which means that the regression model is highly significant at the 0.01 level and the model is usable and meaningful.

After the analysis of Coefficients, a coefficient we found that the unstandardized coefficient of the external supply chain is 0.675 and the standardized coefficient is 0.945, with a p-value of 0.000, which indicates that there is a strong positive correlation between the external supply chain and product innovation performance.

In the regression analysis of the effect of sustainable competitive advantage on product innovation performance, there is an adjusted R-squared of 0.594 as can be seen in the summary of the model. Sustainable competitive advantage (independent variable) explains 59.4% of the variance in product innovation performance (dependent variable). In the test of variance, the F-value is 757.111 and the significance p-value is .000b less than 0.01, which means that the regression model is highly significant at the 0.01 level and the model is usable and meaningful.

After analyzing the Coefficients, a coefficient, we find that the unstandardized coefficient of sustainable competitive advantage is 0.811, and the standardized coefficient is 0.771, with a p-value of 0.000, which indicates that there is a strong positive correlation between sustainable competitive advantage and the performance of product innovation.

After the hierarchical regression analysis of the post-centering data, it can be seen that the level of significance of the coefficient of the interaction term of the post-centering independent variable (External Supply Chain) with the moderator variable (Type of Innovation). In this case, the significance level of the coefficient of the interaction term of the post-centering independent variable and the moderator variable is 0.663, which is greater than 0.05, indicating that the coefficient is not significant, and the moderating effect of the type of innovation on the relationship between the external supply chain and product innovation performance is not significant.

After the hierarchical regression analysis of the post-centering data, it can be seen that the level of significance of the coefficient of the interaction term of the post-centering independent variable (Sustainable Competitive Advantage) with the moderator variable (Type of Innovation). In this case, the significance level of the coefficient of the interaction term between the independent variable and the moderator variable after centering is 0.998, which is greater than 0.05, indicating that the coefficient is not significant and the moderating effect of the type of innovation on the relationship between sustainable competitive advantage and product innovation performance is not significant.

In order to verify the effect of position on the type of innovation, this study utilized a one-way ANOVA test by analyzing the mean difference test of the total scores of the independent and dependent variables of the respondents in different positions. The p-value of the ANOVA test for the type of innovation is 0.294, which is greater than 0.05, indicating that there is no significant effect of the position factor on the type of innovation, i.e., there is no significant difference in the mean value of the effect of the position factor on the moderating variable (type of innovation).

In order to verify the effect of the length of company establishment on the type of innovation, this study utilizes the one-way ANOVA test by analyzing the mean difference test of the total scores of the independent and dependent variables of the respondents in different positions. As analyzed, the p-value of the ANOVA test for the type of innovation is 0.459, which is greater than 0.05, indicating that there is no significant effect of the factor of
the length of the company's establishment on the type of innovation, i.e., there is no significant difference in the mean value of the effect of the factor of the length of the company's establishment on the moderator variable (type of innovation).

In order to verify the effect of the amount of company capital on the type of innovation, this study utilized the one-way ANOVA test by analyzing the test of differences in the means of the total scores of the independent and dependent variables of the respondents in different positions. As analyzed, the p-value of the ANOVA test for the type of innovation is 0.250, which is greater than 0.05, indicating that there is no significant effect of the company capitalization factor on the type of innovation, i.e., there is no significant mean difference in the effect of the company capitalization factor on the moderating variable (type of innovation).

In order to verify the effect of company annual turnover on the type of innovation, this study utilized a one-way ANOVA test by analyzing the mean difference test of the total scores of the independent and dependent variables of the respondents in different positions. As analyzed, the p-value of the ANOVA test for the type of innovation is 0.561, which is greater than 0.05, indicating that there is no significant effect of the annual company turnover factor on the type of innovation. In other words, there is no significant difference in the means of the effect of the length of a company's establishment on the type of innovation. In other words, there is no significant difference in the means of the effect of the annual company turnover factor on the moderating variable (type of innovation).

To verify the effect of the number of employees in the company on the type of innovation, this study utilizes a one-way ANOVA test by analyzing the difference test of the mean of the total scores of the respondents in different positions in the independent variable and the dependent variable. As analyzed, the p-value of the ANOVA test for the type of innovation is 0.023, which is less than 0.05, indicating that the number of employees in the company has a significant effect on the type of innovation. This means that there is a significant difference in the mean value of the number of employees in the company on the effect of the moderator variable (type of innovation).
Discussion

This study provides insights into the relationships between external supply chain (ESC), sustainable competitive advantage (SCA), innovation type (IT), and product innovation performance (PIP). In this discussion, we further explore the findings and compare them with existing literature to understand their implications for theory and practice.

The first objective aimed to assess the ESC-PIP relationship. A strong positive correlation aligns with prior research (Dong & Song, 2019; Longoni et al., 2019), highlighting that an efficient external supply chain enhances information flow, resource access, and innovation collaboration, fostering improved PIP. Similarly, Longoni et al. (2019) found that effective supply chain collaboration positively impacts new product development and innovation capabilities. This underscores the significance of ESC management for innovation.

The second objective explored the SCA-PIP relationship. A significant positive relationship is consistent with previous studies (Ali & Park, 2016; Tang, 2018). Sustainable competitive advantage enables R&D investment, enhancing innovation (Ali & Park, 2016), while unique resources drive innovation and competitiveness (Tang, 2018). This study reinforces the importance of sustaining competitive advantages for successful product innovation.

Objectives three and four examined IT's moderating effects on the ESC and SCA relationships with PIP. No significant moderating effects align with earlier findings (Bocken et al., 2019; Zhang & Wu, 2020), suggesting that the positive impacts of external supply chain and SCA on PIP are consistent across different types of innovation. This supports the notion that organizations should focus on external supply chain and SCA regardless of the specific innovation types they pursue.

Analyzing the mean differences of demographic variables on moderating variables provided insights. While factors like job aspects, company establishment length, capitalization, and turnover lacked significant differences, employee count significantly influenced innovation types, consistent with prior research (Wang & Chen, 2019). Larger firms engage in radical innovations, while smaller ones prioritize incremental or process innovations due to resource constraints.

Theoretical implications enrich innovation and supply chain knowledge. Findings underscore the importance of ESC management and SCA in driving innovation, emphasizing the need for strong external collaborations and unique resources. From a practical standpoint, the study guides leaders in optimizing their innovation strategies. Understanding the dynamics of the external supply chain, SCA, and IT informs decision-making for innovation-driven competitiveness. Leaders should nurture unique capabilities and leverage external supply chains for successful innovation.

Despite these contributions, the study acknowledges its limitations. It was conducted in specific contexts, and industry and regional variations may exist. The sample size and demographics could limit generalizability. Future research with a broader and more diverse sample could validate and extend the findings.

In conclusion, "The Impact of External Supply Chain and Sustainable Competitive Advantage on Product Innovation Performance: The Moderating Roles of Innovation Type" sheds light on the factors influencing innovation performance.
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The strong correlation between external supply chain and product innovation performance highlights the importance of collaboration, while the relationship between sustainable competitive advantage and product innovation performance emphasizes the value of unique resources. Both external supply chain and sustainable competitive advantage have positive impacts on product innovation performance regardless of the specific innovation types pursued. Additionally, the size of the workforce influences innovation types, providing guidance for organizations to foster innovative cultures.

These findings contribute to the knowledge of innovation management and offer practical implications for organizations aiming to enhance their product innovation performance and maintain competitiveness. By leveraging the positive impact of a well-structured external supply chain and a sustainable competitive advantage, organizations can foster innovative cultures for sustained success in dynamic business landscapes.

Conclusion

This study thoroughly examines the complex relationships among external supply chains, sustainable competitive advantage, innovation type, and product innovation performance. The study explores both the direct impacts and the moderating role of innovation type. The conclusion comprehensively analyzes the key findings for each research objective and discusses their implications for theory and practice.

One critical external factor influencing product innovation is the organization's external supply chain. The external supply chain includes suppliers, vendors, and partners collaborating with the focal organization to deliver products and services to the market. The effectiveness of this external supply chain significantly impacts the organization's product innovation performance.

The research findings reveal a strong positive correlation between the effectiveness of the external supply chain and the organization's product innovation performance. This result emphasizes the vital role that a well-structured and efficient external supply chain plays in facilitating innovation within organizations.

Overall, this research significantly contributes to understanding the complex interplay between external supply chain, sustainable competitive advantage, innovation type, and product innovation performance. The strong positive correlation between external supply chain and product innovation performance highlights the importance of collaboration and integration with external partners to drive successful innovation outcomes. Additionally, the positive relationship between sustainable competitive advantage and product innovation performance underscores the value of unique resources and capabilities in fostering a culture of innovation within organizations.

The findings offer practical implications for organizational leaders to optimize their innovation strategies and align their capabilities with innovation goals. Understanding the interplay between external supply chain, sustainable competitive advantage, and innovation type empowers organizations to make informed decisions that foster a culture of innovation, driving sustained success in the ever-evolving business landscape. To leverage the positive impact of a well-structured external supply chain and a sustainable competitive advantage, organizations should foster strong partnerships with external stakeholders and invest in building and sustaining their unique resources and capabilities.
The research's theoretical implications enrich innovation and supply chain knowledge. The study provides valuable insights into the factors influencing product innovation performance and emphasizes the consideration of innovation types when studying the relationships between external supply chain, sustainable competitive advantage, and product innovation performance.

While this study makes significant contributions, it is essential to acknowledge certain limitations. The research was conducted within specific organizational contexts, and variations may exist in different industries or regions. Caution should be exercised when generalizing the findings to other settings. Future research with a larger and more diverse sample is recommended to validate and further explore the relationships between external supply chain, sustainable competitive advantage, innovation type, and product innovation performance.

In conclusion, "The Impact of External Supply Chain and Sustainable Competitive Advantage on Product Innovation Performance: The Moderating Roles of Innovation Type" provides valuable insights into the critical factors influencing innovation performance. By understanding the dynamics between external supply chain, sustainable competitive advantage, innovation type, and workforce size, organizations can make informed decisions to foster a culture of innovation and achieve sustained success in today's competitive business landscape. The research findings contribute to the advancement of knowledge in the field of innovation management and offer practical implications for organizations seeking to enhance their product innovation performance and maintain a competitive edge in the market.

Based on the findings and discussions presented in this study, several recommendations are proposed to enhance the product innovation performance of organizations, considering the impact of external supply chain and sustainable competitive advantage, as well as the role of innovation type and workforce size as moderating factors.

1. Strengthen External Supply Chain Collaboration: Organizations should focus on developing strong collaborations with external suppliers, vendors, and partners to enhance their product innovation performance. This can be achieved through regular communication, information sharing, and joint problem-solving activities. By fostering a collaborative and integrated external supply chain, organizations can tap into external expertise and resources, leading to improved innovation outcomes.

2. Foster Sustainable Competitive Advantage: Sustaining a competitive advantage is crucial for driving product innovation performance. Organizations should identify their unique resources and capabilities and continuously invest in them to maintain their competitive edge. This might involve developing strong research and development capabilities, building a strong brand reputation, or establishing proprietary technologies. By nurturing sustainable competitive advantage, organizations can consistently deliver innovative products to the market.

In conclusion, the recommendations provided above aim to guide organizations in optimizing their innovation strategies and leveraging external supply chains and sustainable competitive advantage to enhance their product innovation performance.

By adopting these recommendations, organizations can foster a culture of innovation, strengthen their competitive position in the market, and achieve sustainable growth and success in today's dynamic business landscape.
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