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A Proposed Framework of the Impact of Knowledge Management and Green Innovation on the Sustainable Development of Cross-Border E-Commerce Enterprises: The Moderating Role of Artificial Intelligence

Yufang Leng[1,2,*], Chunrong Huang[1], Renchao Lu[1], Xinxiang Gao[2], Ying Zou[2]

[1]*Guangxi Wuzi School, Nanning, Guangxi, 530006, China*
[2]*Graduate School of Business, SEGI University, Kota Damansara, Selangor, 47810, Malaysia*
[*]*Corresponding author: Lengyufang567@gmail.com*

Abstract: *The sustainable development of cross-border e-commerce enterprises is influenced by a variety of factors, and this study focuses on three factors, knowledge management, green innovation and artificial intelligence. The theories that will be tested in this conceptual paper include the Resource-Based Theory, and the Sustainable Development Theory. This paper examines the relationship between these two theories and how each theory affects the sustainable development of cross-border e-commerce enterprises and investigates the importance of the independent variables in the conceptual framework. According to the "China Cross-border E-commerce market outlook and Investment Opportunities Research Report," Guangdong Province in China is the province with the largest number of cross-border e-commerce enterprises. Therefore, this study collects data on cross-border e-commerce enterprises in Guangdong Province. To test the hypotheses, quantitative methods and purposive sampling methods will be used. In addition, the data will be analyzed using SPSS and PLS-SEM.*

Keywords: *Knowledge Management, Green Innovation, Artificial intelligence, Sustainable Development, Cross-Border E-Commerce Enterprises*

1. Introduction

China is one of the world's major e-commerce marketplaces, and cross-border e-commerce is a key element of it, with tremendous development in recent years. China's cross-border e-commerce imports and exports will surpass 2 trillion yuan for the first time in 2022, hitting 2.1 trillion yuan, a rise of 7.1% from 2021, according to statistics from China's General Administration of Customs, and cross-border e-commerce has given China's overseas trade a new boost. The Chinese government, in the last decade, has continued to support the development of cross-border e-commerce by enacting a series of favourable regulations [22]. For example, the State Council has issued laws such as the Opinions on Promoting the Healthy Development of Cross-Border E-Commerce and the Announcement on Tax Policies for Export Tax Refunds on Cross-Border E-Commerce Goods for the Period 2015-2023 (No. 4 of 2023). These policies call for a variety of support efforts, such as streamlined customs procedures, enhanced logistics and distribution, and lower tax responsibilities. These legislative developments have created an environment that is favourable to the growth of cross-border e-commerce enterprises in China [6].

Among Chinese cross-border e-commerce enterprises, technological innovation has become one of the main factors influencing their success. With the continuous advancement of Internet technology, Chinese cross-border e-commerce enterprises are actively exploring new business models and technology applications [4]. For example, through the application of technologies such as artificial intelligence, big data analytics and the Internet of Things, cross-border e-commerce enterprises are now able to better understand customer needs, increase operational efficiency and improve supply chain management[5]. In addition, thanks to technological advances in areas such as mobile payments and logistics and distribution, Chinese cross-border e-commerce enterprises now have access to more practical and efficient services [23].

Chinese cross-border e-commerce enterprises have proved to be fierce competitors on the global stage.

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China has a sizable domestic consumer market and abundant product resources, providing opportunities for cross-border e-commerce enterprises to develop. As a result, Chinese cross-border e-commerce enterprises are actively entering foreign markets[12]. They have established logistics and warehousing networks in foreign countries and provided locally adapted services, thus raising the level of competition in the global market. In addition, Chinese cross-border e-commerce enterprises have actively engaged in international cooperation to promote trade links with other countries and regions and improve their competitiveness in the world[24]. Although China's cross-border e-commerce still shows a trend of continuous forward development, there are many obstacles, and difficulties such as inefficient customs clearance, regulatory intricacies, tax rebate and settlement issues, payment risks, and a lack of scientific management rules[28]. As the competitive landscape intensifies and societal expectations for sustainability evolve, cross-border e-commerce enterprises face increasingly complex challenges that require special knowledge and innovation capabilities to address the associated barriers [13].

Innovation and knowledge management are generally recognised as critical components in an organization's sustainability and competitiveness [7]. Knowledge management encompasses the activities of knowledge development, acquisition, sharing, and application in order to assist enterprises in making the most use of their knowledge resources [1]. Green innovation focuses on the development of environmentally friendly technology and management strategies in order to decrease negative environmental consequences. Meenu Chopra's article argues that it would also be effective to use AI as a supporter and facilitator of knowledge management for sustainable development [27].

2. Research Questions

RQ1: What is the effect of knowledge management on the sustainable development of cross-border e-commerce enterprises?

RQ2: What is the effect of green innovation in relation to the sustainable development of cross-border e-commerce enterprises?

RQ3: What is the moderating effect of Artificial Intelligence in the relationship between knowledge management and sustainable development of cross-border e-commerce enterprises?

3. Research Objectives

RO1: To study the effect of knowledge management on sustainable development of cross-border e-commerce enterprises.

RO2: To study the effect of green innovation on the sustainable development of cross-border e-commerce enterprises.

RO3: To investigate the moderating role of Artificial Intelligence between knowledge management and sustainable development of cross-border e-commerce enterprises.

4. Literature Review

The key premise of this research is Resource-Based Theory (RBT), which emphasises the critical significance of internal resources and skills in establishing and maintaining competitive advantage [9]. Green innovation and knowledge management are two critical internal resources for cross-border e-commerce enterprises[29]. Wang et al. define knowledge management as the systematic collection, organization, usage, and distribution of knowledge within an organization. Effective knowledge management may give a substantial advantage in cross-border e-commerce, where information and market dynamics are continually changing. Enterprises that can effectively obtain, process, and exploit information about market trends, customer behavior, and future technologies are better positioned to react to changing market circumstances and maintain long-term operations [2]. Green innovation, on the other hand, is concerned with the creation and implementation of ecologically friendly activities and technology. In a period where sustainability has become a worldwide concern, cross-border e-commerce enterprises must not only meet customer needs but also follow environmental standards and decrease their environmental imprint. By implementing green innovation into their strategy, these businesses may not only stay compliant, but also attract environmentally concerned customers and investors[3].This study supports the claim that cross-border e-commerce enterprises with strong knowledge management and green innovation processes are more likely to create sustainable competitive advantages via the lens of

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RBT [25]. They can negotiate the difficulties of their changing environment and contribute positively to ecological and economic sustainability by properly using these internal resources [11].

Sustainable Development Theory gives the research an ethical and sociological framework. It highlights the significance of connecting corporate operations with long-term ecological, social, and economic objectives[26]. This method expands the study of cross-border e-commerce enterprises by stressing the broader consequences of their activities on the environment and society. Cross-border e-commerce, which is frequently characterized by worldwide supply chains and substantial logistics, may put enormous environmental constraints on the environment [15]. These businesses must examine not just their profit margins, but also their carbon footprints, responsible sourcing procedures, and community well-being[19]. The inclusion of green innovation as a critical aspect of the study is supported by Sustainable Development Theory, which emphasizes the need for businesses to adopt practices that minimize environmental harm and contribute positively to sustainable development goals. Furthermore, the idea emphasizes the significance of long-term thinking and aligning enterprise strategy with sustainability principles. It offers a framework for analyzing cross-border e-commerce activities' social responsibility and ethical consequences [31]. As a result, this research supports the thesis that cross-border e-commerce enterprises must combine knowledge management and green innovation to align their operations with sustainable development principles [30].

The process by which a company creates, acquires, shares and applies internal and external knowledge to improve performance and create sustainable development advantage is known as knowledge management. Knowledge management has an immeasurable impact on the sustainable development of enterprises as it enables organizations to leverage their intellectual capital, promote innovation, improve decision-making processes and increase overall productivity. Effective knowledge management also improves the decision-making process within an organization. By giving employees easy access to relevant information and expertise, organizations can make more informed decisions [14]. Employees are able to quickly find solutions to problems and make more accurate decisions through knowledge bases, databases and search engines. This reduces reliance on individual expertise and ensures that decisions are based on a broader understanding of the organization's collective knowledge. In turn, this leads to better results and more sustainable business practices. Additionally, knowledge management streamlines workflows and reduces duplication of effort, thereby increasing overall efficiency. By using a knowledge management system, enterprises can automate routine tasks, capture best practices, and provide employees with standardized processes and templates. This allows employees to work more efficiently, saving time and resources. In addition, by leveraging the knowledge and expertise of employees, enterprises can avoid duplication of effort and drive continuous improvement based on existing knowledge [18]. Finally, knowledge management is very much needed for the sustainable development of enterprises, and it plays an important role[32]. Enterprises can use intellectual capital to accomplish the protection and transfer of organizational knowledge, stimulate innovation, enhance decision-making processes and increase productivity, thereby gaining a competitive advantage in the marketplace. If an enterprise adopts a knowledge management strategy, it can adapt to changing environments, remain resilient and achieve long-term prosperity [20].

Green innovation is the creation and use of new technologies, processes, and products that have a beneficial environmental effect. Renewable energy, waste reduction, resource efficiency, and sustainable practices are all part of it. Green innovation contributes to environmental advantages, economic gains and social responsibility, and has a significant impact on the company's sustainable development. Green innovation may help the environment by minimising negative environmental consequences via a variety of techniques, such as lowering economic activity. Enterprises may apply green practise to lower their carbon footprint, conserve natural resources, and reduce pollution; for example, using renewable energy sources like solar or wind power can dramatically cut greenhouse gas emissions [10]. Adopting energy-efficient technologies and processes can also reduce energy consumption and waste generation. These green practices not only help to preserve the planet for future generations, but also enhance a company's reputation as a responsible steward of the environment. Green innovations provide economic advantages for businesses. While there may be initial costs associated with implementing green technologies or redesigning processes, the long-term benefits outweigh these investments. Energy-efficient practices often result in cost savings through reduced utility bills and lower operating expenses. In addition, enterprises that develop innovative green products or services can capitalize on growing consumer demand for sustainable choices. This opens up new sources of revenue and expands business opportunities. Furthermore, sustainable development raises brand value and attracts environmentally concerned clients ready to pay a premium for environmentally friendly goods or services [16]. Green innovation is consistent with the principle of social responsibility. Businesses have a moral obligation to make positive contributions to society and to address environmental challenges. By adopting

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sustainable practices, businesses can demonstrate their commitment to social responsibility by minimizing negative impacts on communities and ecosystems. This may include initiatives such as responsible waste management, ethical sourcing of materials, and supporting local communities through job creation or charitable activities[21].Green innovation allows enterprises to be seen as good corporate citizens, prioritizing the well-being of society and actively contributing to sustainable development.

Academic scientists have recently given the issue of artificial intelligence more attention. The Dartmouth Research Project defined artificial intelligence as the task of "making a machine behave in ways that would be termed intelligent if a human being behaved like this" [8].As a result, artificial intelligence is capable of accurately reading outside data and applying these lessons to achieve certain goals and tasks via adaptable setup. Moreover, human activities, "which have cognitive, emotional, and social intelligence," may be accurately replicated by intelligent systems. Machine learning and artificial intelligence are also accessible in other formats. Nonetheless, the objective is to manage and supply intelligent products, services, and experiences via knowledge sharing in order to support collaborative or sustainable value creation. According to Palomares et al., artificial intelligence can show how it may be useful in achieving the sustainable development objectives [17].

Hypotheses have been proposed in this study based on the reviews and previous discussion.The hypotheses are listed here.(As shown in figure 1:A Proposed Conceptual Model/Framework).

H1: Knowledge creation has a significant impact on the sustainable development of cross-border e-commerce enterprises.

H2: Knowledge acquisition has a significant impact on the sustainable development of cross-border e-commerce enterprises.

H3: Knowledge sharing has a positive impact on the sustainable development of cross-border e-commerce enterprises.

H4: Knowledge application has a significant impact on the sustainable development of cross-border e-commerce enterprises.

H5: Green technology innovation has a meaningful impact on the sustainable development of cross-border e-commerce enterprises.

H6: Green management innovation has a significant impact on the sustainable development of cross-border e-commerce enterprises.

H7: Artificial Intelligence has a moderating effect on knowledge management and sustainable development of cross-border e-commerce enterprises.

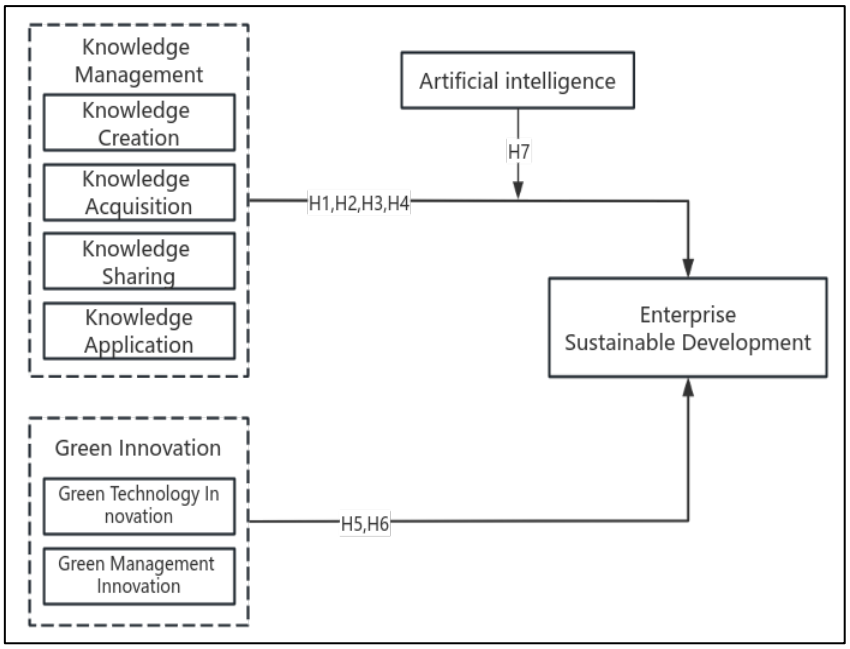

Figure 1: Conceptual Framework

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5. Research Methodology

Our study will use the paradigm of positivist research. The process of developing theory using deductive reasoning. Single method quantitative method is chosen as the method of choice. The strategy was to conduct a survey. The time horizon is cross-sectional. The quantitative sampling strategy method used is called purposive sampling. PLS- SEM and SPSS are the software used for data analysis. The location of the study was identified as Guangdong Province in China, because according to the "China cross-border e-commerc market outlook and investment opportunities research report," Guangdong Province in China is the province with the largest number of cross-border e-commerce enterprises. The researchers intend to give their findings to the cross-border e-commerce enterprise with the relevant government departments.

6. Conclusions

The theoretical significance of this study is mainly: First, this research can bridge the domains of knowledge management and sustainability theories. While knowledge management has long been recognized as a critical organizational process, its direct relationship with sustainability in cross-border e-commerce settings has been relatively unexplored. By establishing connections between knowledge management practices and sustainability outcomes, this study can enrich the theoretical foundations of both fields. Second, this research will broaden ideas about green innovation and business sustainability. While prior research has emphasised the role of innovation in promoting sustainable development, this study adds depth by exposing the particular processes through which green innovation enhances the sustainable growth of cross-border e-commerce enterprises. Third, this study can present a comprehensive theoretical framework that elucidates the interactions between knowledge management, green innovation AI and sustainable development. The framework can provide a valuable reference for future research work and a structured perspective for scholars to study sustainable development in cross-border e-commerce.

The practical significance of this study is mainly: First, cross-border e-commerce companies can gain strategic insights from this study. The results of the study will guide for optimizing knowledge management processes, taking advantage of green innovation opportunities, and effectively using artificial intelligence tools. This strategic direction can improve the sustainability performance of these enterprises sustainable development and promote sustainable development. Second, policymakers and regulators can benefit from this study by understanding the role of knowledge management and green innovation in sustainable cross-border e-commerce enterprises. This understanding may contribute to the development of rules and legislation that support ecologically responsible practices, ethical data use, and the adoption of developing e-commerce technologies. Third, this study will emphasize the significance of using AI technologies to improve knowledge management and sustainable development. Technology providers and developers can use these insights to improve their capabilities by tailoring AI solutions, especially for cross-border e-commerce organizations.

In conclusion, this is the first study to assess the impact of knowledge management and green innovation on cross-border e-commerce enterprise sustainable development using artificial intelligence as a moderating variable. Therefore, the findings of this study may be beneficial for the sustainable development of relevant cross-border e-commerce enterprises. In addition, this study will provide an opportunity to promote cooperation among stakeholders and encourage cross-border e-commerce enterprises, technology providers, policymakers, and consumers to work together to achieve sustainable development. Through collaboration, industry standards, responsible data-sharing practices, and innovative solutions to sustainability challenges can be developed. The theoretical and practical implications of this study can provide insights that can be put into practice for good change in cross-border e-commerce enterprises and contribute to a more sustainable digital future.

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