Article
Unveiling the Influence: Exploring the Impact of Interrelationships among E-Commerce Supply Chain Members on Supply Chain Sustainability

Stavros Sindakis 1,*, Saloome Showkat 2 and Jiafu Su 3,*

1 School of Social Sciences, Hellenic Open University, 18 Aristotelous Street, 26335 Patras, Greece
2 InnoLab Research, Talient Education, Athens, Greece; s.showkat@talient.edu
3 International College, Krirk University, Bangkok 10220, Thailand
* Correspondence: sindakis.stavros@ac.eap.gr (S.S.); jiafu.su@hotmail.com (J.S.)

Abstract: This study explores the critical role of interrelationships among e-commerce supply chain members in shaping sustainability outcomes. It adopts a qualitative approach, drawing from Sustainable Supply Chain Management (SSCM) and Resource Dependency Theory (RDT) to gain a deeper understanding of sustainability within e-commerce supply chains. In a comprehensive investigation involving 35 key stakeholders from prominent e-commerce companies in China, such as Amazon, Alibaba, Suning.com, Shein, and Wayfair, this research examines how robust interrelationships, characterized by collaboration, knowledge exchange, trust-building, and joint problem-solving, facilitate efficient resource utilization, innovation, waste reduction, and enhanced social and environmental responsibility throughout the supply chain. The findings underline the practical implications for supply chain managers and practitioners, emphasizing the need to foster these robust interrelationships through effective communication, trust-building, collaboration, and information sharing as tangible strategies to elevate sustainability performance and gain a competitive edge in the dynamic e-commerce landscape. The insights are based on structured, in-depth interviews conducted in English with participants familiar with the language, lasting approximately 35 to 55 min.

Keywords: e-commerce supply chains; interrelationships; collaboration; trust; qualitative research; sustainability

1. Introduction

The sustainability of e-commerce supply chains has gained significant attention in the field of supply chain management [1,2]. This focus is driven by the increasing environmental consciousness and social responsibility among businesses [3]. E-commerce, which has rapidly transformed traditional supply chain models, presents both challenges and opportunities for sustainability [4]. It has been fueled by technological advancements, shifting consumer preferences, and the widespread adoption of online platforms [5]. However, this growth has also raised concerns about environmental impacts, such as energy consumption, packaging waste, and transportation emissions [6,7], and underscored the importance of the social dimension of sustainability [8,9].

In this context, understanding the interrelationships among supply chain members is crucial [9,10]. These interrelationships involve collaboration, communication, and coordination among stakeholders in e-commerce supply chains [11,12], significantly affecting overall sustainability [13]. The COVID-19 pandemic has further highlighted the importance of sustainable e-commerce supply chains [14,15]. The surge in online shopping during the pandemic has placed unprecedented pressure on supply chains to adapt and ensure uninterrupted delivery of goods and services [16]. In this new era, sustainability is not just about environmental and social responsibility but also about resilience and agility [17]. E-commerce supply chains must navigate disruptions, changes in consumer behavior,
and global uncertainties [18,19], with the interrelationships among supply chain members playing a crucial role in building resilient networks [20,21].

This research aims to provide insights into how interrelationships among e-commerce supply chain members impact sustainability. Collaborative partnerships, effective communication, and information sharing among supply chain members can foster agility and quick decision-making and enhance the overall resilience of the supply chain network [22,23]. Our study seeks to help organizations thrive in the evolving landscape of e-commerce while ensuring sustainability and meeting the needs of customers in the new normal. By exploring the intrinsic dimensions of sustainable e-commerce supply chains [24,25], we aim to shed light on the significance of interrelationships among supply chain members and how these interrelationships contribute to sustainability outcomes, such as reduced environmental impact, improved social well-being, and long-term economic viability.

While research on supply chain sustainability has made significant progress, there is a specific gap concerning the impact of interrelationships among e-commerce supply chain members [25–27]. Existing studies have predominantly focused on external factors, such as environmental regulations and supplier selection [26,28,29], overlooking the intricate dynamics and relationships within the supply chain. This research aims to fill this gap by exploring the influence of interrelationships, including collaboration, communication, trust, and coordination, on the sustainability outcomes of e-commerce supply chains. Our study’s objectives are as follows:

1. Assess the impact of interrelationships between manufacturers and suppliers on the sustainability outcomes of e-commerce supply chains.
2. Examine the role of e-commerce platform operators in promoting sustainability.
3. Evaluate the effectiveness of logistics providers in implementing sustainable practices and their impact on the sustainability outcomes of e-commerce supply chains.
4. Investigate the influence of consumer behavior and engagement on the sustainability of e-commerce supply chains.

This study combines Sustainable Supply Chain Management (SSCM) and Resource Dependency Theory (RDT) to explore the intricate dynamics of interrelationships among e-commerce supply chain members and their impact on sustainability outcomes. SSCM emphasizes holistic sustainability practices, considering economic, environmental, and social factors and promoting collaboration, life cycle thinking, and supplier management [30,31]. RDT focuses on power dynamics and resource dependencies, highlighting the role of collaboration and coordination in addressing vulnerabilities [32]. Through this integration, the study seeks to understand how these interrelationships influence sustainability in e-commerce supply chains, providing insights for supply chain professionals and policymakers. To achieve these objectives, a total of 35 participants were selected to provide their insights and perspectives on the impact of interrelationships among e-commerce supply chain members on sustainability outcomes. This selection focused on key stakeholders from prominent e-commerce companies in the Chinese marketplace, including Amazon, Inc., Alibaba Group Holding Ltd., Suning.com, Shein, and Wayfair. These companies were chosen due to their significant presence and influence in the e-commerce industry, as well as their sustainability initiatives. The in-depth interviews were conducted in English, as all participants were familiar with it. The interviews lasted approximately 35 to 55 min and followed a structured format.

Our research seeks to advance our understanding of SSCM practices by exploring the impact of interrelationships among e-commerce supply chain members on sustainability outcomes. The findings of this study will provide valuable insights for supply chain managers, policymakers, and industry practitioners, ultimately contributing to the development of more sustainable and resilient e-commerce supply chains.

2. Literature Review

The theoretical underpinnings of this study are rooted in two key theories: SSCM and RDT [33,34]. These theories provide a foundation for understanding the dynamics of
interrelationships among supply chain members and their influence on the sustainability outcomes of e-commerce supply chains.

SSCM represents a profound shift in how businesses approach their supply chain operations [35]. Beyond just focusing on economic gains, SSCM recognizes the critical need to consider environmental and social aspects in supply chain practices [36]. This approach is grounded in the understanding that the long-term viability and competitiveness of an organization are intricately tied to its ability to operate sustainably. The first key element of SSCM is its triple-bottom-line perspective [37]. In this framework, sustainability is not just about profitability but also about minimizing negative environmental impacts and enhancing social well-being. This holistic view acknowledges that economic success cannot be achieved at the expense of environmental degradation or social injustices [38]. Thus, companies adopting SSCM principles strive to balance their economic objectives with environmentally responsible practices (such as reducing emissions, waste, and resource consumption) and socially responsible actions (such as fair labor practices, community engagement, and ethical sourcing) [39].

Another critical aspect of SSCM is the recognition that individual organizations cannot address sustainability challenges in isolation. Instead, they require collaboration and coordination among multiple stakeholders across the supply chain. This collaborative approach acknowledges that suppliers, customers, regulatory bodies, and the community all play a role in shaping the sustainability performance of a company [40]. Therefore, SSCM encourages businesses to engage with these stakeholders, share information, set common goals, and work together to find innovative solutions that promote sustainability. Additionally, SSCM emphasizes the importance of taking a life cycle perspective, which means considering the environmental and social impacts of products and services from their creation to disposal [41]. This approach helps identify opportunities for improvement throughout the entire supply chain, from sourcing raw materials to manufacturing, distribution, and end-of-life disposal or recycling. Managing supplier relationships is another vital element of SSCM, as suppliers can have a significant impact on a company’s sustainability performance [42]. SSCM encourages companies to select suppliers who share their sustainability goals and values and work closely with them to ensure adherence to sustainability standards and practices. This can involve regular monitoring, audits, and capacity building to help suppliers meet sustainability requirements. Finally, SSCM promotes collaboration and partnerships as a means of achieving sustainability objectives [43]. By working with other organizations, whether through industry collaborations, cross-sector partnerships, or engagement with non-governmental organizations, businesses can leverage collective expertise and resources to address complex sustainability challenges more effectively. These collaborations can lead to shared best practices, knowledge exchange, and joint efforts to drive sustainability improvements throughout the supply chain. In conclusion, SSCM is a multifaceted framework that goes beyond traditional supply chain practices. It encompasses environmental, social, and economic dimensions of sustainability, recognizes the interconnectedness of these aspects, emphasizes collaboration and stakeholder engagement, takes a life cycle perspective, focuses on supplier management, and encourages partnerships. Companies that embrace SSCM principles are better positioned to meet the challenges of the 21st century, including environmental conservation, social responsibility, and economic viability, while also contributing to a more sustainable and equitable global economy [44].

In the context of this study, SSCM provides a comprehensive approach to managing sustainability in e-commerce supply chains [45]. It considers the environmental impact of e-commerce activities, such as energy consumption, packaging waste, and transportation emissions [46]. It also recognizes the social dimension of sustainability, emphasizing fair working conditions, ethical sourcing practices, and responsible consumption [47]. By adopting the principles of SSCM, organizations can align their operations with sustainable practices and contribute to the overall sustainability of e-commerce supply chains [48].
Resource Dependence Theory (RDT), as applied to e-commerce supply chains, offers valuable insights into the intricate web of interdependencies among organizations and their profound impact on behavior and decision-making processes [49]. Central to RDT is the premise that organizations rely on external resources controlled by other organizations [50]. Within the dynamic landscape of e-commerce supply chains, this concept resonates prominently, as manufacturers, suppliers, logistics providers, and e-commerce platform operators find themselves in a state of mutual dependence on each other for the essential resources required to function efficiently. This interdependence, far from being a challenge, presents fertile ground for collaboration and coordination, essential for sustainability [51]. At the heart of RDT lies the notion of power and control within inter-organizational relationships. Organizations possessing greater power wield the ability to influence the behaviors and decisions of other members within the supply chain ecosystem [52]. In the context of e-commerce supply chains, disparities in power can exert significant effects on collaboration, the sharing of vital information, and the processes governing decision-making. Recognizing and comprehending these power dynamics becomes imperative for effectively managing interrelationships within the intricate fabric of e-commerce supply chains [53].

Furthermore, RDT underscores the pivotal role of collaboration and coordination in mitigating resource dependencies. Organizations often join forces to pool resources, share knowledge, and collectively address sustainability challenges that transcend individual capacities. In this context, effective communication and coordination mechanisms emerge as linchpins for managing interdependencies and advancing toward shared sustainability objectives [54]. In essence, RDT illuminates the intricate dance of power, control, collaboration, and coordination within the complex network of e-commerce supply chains. It underscores the need for a nuanced understanding of these dynamics to foster productive interrelationships, mitigate resource vulnerabilities, and collectively strive toward sustainability in the ever-evolving e-commerce landscape.

By integrating SSCM and RDT, this study aims to uncover how the interrelationships among supply chain members in e-commerce supply chains contribute to sustainability outcomes. It considers the principles of SSCM to address sustainability challenges and the concepts of resource dependence and power dynamics from RDT to understand the dynamics of inter-organizational relationships. Through this theoretical lens, the study seeks to advance our understanding of SSCM practices in the context of e-commerce and provide practical insights for supply chain managers, policymakers, and industry practitioners.

2.1. Supply Chain Sustainability

Supply chain sustainability is a critical area of focus within supply chain management. It involves considering and integrating environmental, social, and economic aspects into supply chain design, operation, and management [55]. The environmental dimension of supply chain sustainability emphasizes the need to minimize the negative impact of supply chain activities on the natural environment. It involves adopting practices that reduce resource consumption, waste generation, and emissions [56]. Existing literature has highlighted various strategies and initiatives to achieve environmental sustainability in supply chains [57–59]. For instance, green procurement practices aim to select suppliers that adhere to environmentally responsible practices. Eco-design focuses on developing environmentally friendly products throughout their lifecycle [60]. Additionally, studies have explored implementing reverse logistics processes to optimize the management of product returns, recycling, and remanufacturing [61,62].

The social dimension of supply chain sustainability addresses the ethical and social considerations associated with supply chain activities. It involves ensuring fair labor practices, promoting human rights, and engaging in responsible sourcing [63]. Existing literature has examined working conditions in supply chains, including working hours, wages, and workplace safety [64,65]. Researchers have emphasized the importance of ethical sourcing practices, including traceability and transparency in supply chains, to prevent human rights violations and promote responsible business conduct [64,66]. Community
engagement initiatives, where organizations collaborate with local communities to foster social development and well-being, have also been explored [67].

The economic dimension of supply chain sustainability focuses on the long-term viability and profitability of supply chain operations [60]. It recognizes that sustainability initiatives should maintain the economic performance of organizations. Instead, sustainable practices can lead to cost savings, operational efficiency, and enhanced brand reputation [68]. The existing literature has examined the business case for supply chain sustainability, highlighting the potential benefits of integrating sustainability principles into supply chain management [69]. Studies have shown that organizations prioritizing sustainability can achieve competitive advantage and better financial performance in the long run [70,71].

The existing literature has also explored practices related to supply chain sustainability. This includes the adoption of sustainability certifications and standards, such as ISO 14001 for environmental management and Fairtrade certification for ethical sourcing [72]. Collaborative partnerships and supplier engagement programs have also been studied as effective strategies for promoting sustainability throughout the supply chain [73]. Additionally, technology and digitalization, such as blockchain, have been investigated to enhance transparency, traceability, and accountability in supply chains [74]. Therefore, the existing literature on supply chain sustainability offers a wealth of knowledge on the definition, dimensions, and importance of sustainability in supply chain management. It highlights the environmental, social, and economic aspects of sustainability and its interconnectedness. This knowledge base provides valuable insights for organizations seeking to develop sustainable supply chain strategies and practices, enabling them to achieve both environmental responsibility and long-term business success.

2.2. Interrelationships in Supply Chains

Interrelationships among supply chain members play a crucial role in achieving sustainable outcomes within supply chains [75]. Interrelationships in supply chains refer to the connections and interactions between various stakeholders involved in the supply chain, including manufacturers, suppliers, logistics providers, and customers [76]. These interrelationships can take different forms, ranging from formal partnerships and strategic alliances to informal collaborations and information-sharing networks. The literature emphasizes that these interrelationships are not only essential for operational efficiency but also for achieving sustainable outcomes within supply chains [77].

Existing literature has recognized the significance of interrelationships in driving sustainable supply chain practices. Partnerships and collaborations enable stakeholders to pool their resources, knowledge, and expertise, leading to more effective sustainability initiatives [78,79]. Studies have shown that when supply chain members collaborate, they can jointly develop and implement sustainability strategies, share best practices, and overcome common challenges [80,81]. Collaborative relationships foster trust, enhance communication, and encourage the exchange of ideas and information, which are crucial for sustainable decision-making [82].

Moreover, the literature highlights the importance of interrelationships in influencing supply chain performance and resilience [83]. Strong inter-organizational relationships can lead to improved supply chain performance, including cost reduction, enhanced product quality, and increased customer satisfaction [84]. When supply chain members work together, they can better coordinate their activities, align their goals, and respond to market changes more effectively. This collaboration contributes to a more efficient and resilient supply chain that can adapt to disruptions and uncertainties [85].

Power dynamics and trust are key factors within inter-organizational relationships that have been extensively studied in the literature [86,87]. Power dynamics refer to the distribution of influence and control among supply chain members. Research has examined how power imbalances can affect sustainability outcomes within the supply chain [88]. For instance, when a dominant player exerts excessive power, collaboration and information sharing may impede sustainability efforts. On the other hand, trust has been found to be a
vital element in fostering collaboration and cooperation. Establishing trust among supply chain members encourages knowledge-sharing, risk-taking, and joint problem-solving, facilitating sustainability initiatives [89].

Information sharing is another critical aspect of interrelationships that has received considerable attention in the literature [90]. Transparent and timely information exchange among supply chain members is essential for sustainable decision-making and performance improvement [91]. Studies have explored the role of information sharing in enhancing supply chain visibility, traceability, and responsiveness, thereby enabling more sustainable practices. Emerging technologies such as blockchain, IoT (Internet of Things), and data analytics have been investigated as enablers for efficient and secure information sharing among supply chain partners [92,93].

Therefore, the existing literature on interrelationships in supply chains provides valuable insights into the importance of collaboration, communication, coordination, and partnerships for achieving sustainable outcomes. It highlights the impact of these interrelationships on supply chain performance, decision-making, and resilience. The literature also acknowledges the role of power dynamics, trust, and information sharing as crucial factors within inter-organizational relationships. By understanding and leveraging these interrelationships, supply chain managers can foster sustainable practices, enhance performance, and build resilient supply chains capable of adapting to the evolving business landscape.

2.3. E-Commerce Supply Chains

E-commerce supply chains have gained significant importance in recent years, driven by the rapid growth and transformation of online retail [94]. The growth of e-commerce can be attributed to several factors. Technological advancements, particularly in internet connectivity and mobile devices, have made online shopping more accessible and convenient for consumers [95]. This has led to a shift in consumer behavior, with more people opting to shop online for a wide range of products. Changing consumer preferences, such as the desire for convenience, product varieties, and personalized experiences, have further fueled the growth of e-commerce [96]. The literature highlights the importance of understanding these factors to grasp the unique dynamics and challenges of e-commerce supply chains [97].

E-commerce supply chains face distinct environmental challenges compared to traditional retail supply chains. The increased reliance on transportation, packaging, and last-mile delivery in e-commerce operations contributes to higher energy consumption and transportation emissions [98]. Additionally, the rise of e-commerce has led to a surge in packaging waste, as individual products are often shipped in separate packages. These environmental concerns have prompted researchers and practitioners to explore sustainable practices and innovations in e-commerce supply chains [99]. Existing literature has examined various strategies, such as optimizing transportation routes, adopting eco-friendly packaging materials, and promoting recycling and waste reduction, to mitigate the environmental impact of e-commerce [100].

E-commerce platforms, logistics providers, and consumers play key roles in shaping the sustainability of e-commerce supply chains. E-commerce platforms, as intermediaries between buyers and sellers, have the potential to influence sustainable practices by setting standards, promoting eco-friendly products, and providing information to consumers [101]. Existing literature has examined the sustainability initiatives undertaken by e-commerce platforms, such as green packaging options, carbon footprint reduction programs, and responsible sourcing initiatives. Logistics providers, including transportation companies and last-mile delivery services, play a critical role in the environmental impact of e-commerce supply chains [102]. Researchers have explored strategies for optimizing delivery routes, adopting electric vehicles, and promoting sustainable logistics practices. Finally, consumer behavior and engagement are essential in driving sustainability in e-commerce [103]. Studies have examined consumer attitudes towards sustainable products, willingness to pay for eco-friendly options, and the impact of sustainability information on purchase deci-
sions. Understanding consumer preferences and behaviors is crucial for designing effective sustainability strategies within e-commerce supply chains [104]. Therefore, the existing literature on e-commerce supply chains emphasizes the unique characteristics, challenges, and opportunities associated with online retail. It explores the factors contributing to the growth of e-commerce, such as technological advancements and changing consumer preferences. The literature also highlights the environmental and social challenges specific to e-commerce, such as energy consumption, packaging waste, and fair working conditions. Moreover, it discusses the roles of e-commerce platforms, logistics providers, and consumers in shaping the sustainability of e-commerce supply chains. Through numerous studies and research, scholars have proposed strategies, frameworks, and practices to address these challenges and promote sustainability within e-commerce supply chains.

2.4. Research Gaps

The existing body of research dedicated to supply chain sustainability within the context of e-commerce has undeniably contributed significantly to our comprehension of sustainable practices and challenges. Nevertheless, it is imperative to acknowledge a conspicuous research void that persists in the realm of understanding the profound impact that interrelationships among e-commerce supply chain constituents wield over sustainability outcomes. While prior studies have diligently examined various facets of supply chain sustainability, a recurrent deficiency lies in their propensity to overlook the intricate dynamics and relationships that pervade the internal ecosystem of supply chains, especially within the unique context of e-commerce [105,106].

A critical limitation discernible within the extant literature pertains to its conspicuous oversight regarding the specific interconnections among e-commerce supply chain participants and their tangible influence on sustainability outcomes. While external factors such as environmental regulations and supplier selection have understandably garnered substantial attention from researchers, a notable dearth of scholarly inquiry delves into the intricate internal dynamics and relationships that pervade the multifaceted e-commerce supply chain network (as attested by references [107]). This research lacuna acts as a proverbial blind spot that restricts our holistic understanding of how these intricate interrelationships, whether among manufacturers, suppliers, e-commerce platform operators, logistics providers, or consumers, collectively contribute to the overarching sustainability performance of e-commerce supply chains.

The disregard for the impact of interrelationships within the existing literature represents an inherent inadequacy, as it fails to encapsulate the full complexity of e-commerce supply chains and the far-reaching implications these interconnections hold for sustainability. Interrelationships within supply chains encompass a gamut of collaborative endeavors, intricate communication channels, trust-building mechanisms, and coordination efforts among the network of supply chain actors. These multifaceted interactions hold immense potential to wield a substantial influence on sustainability outcomes, a fact substantiated by pertinent literature [108]. For instance, the efficacy of collaboration between manufacturers and suppliers can manifest in enhanced environmental performance through joint initiatives targeting waste reduction and resource optimization. In a similar vein, robust partnerships formed between e-commerce platform operators and sellers can serve as catalysts for responsible sourcing practices and the promotion of ethical conduct within the supply chain [109].

Furthermore, the deficiency of research on interrelationships within e-commerce supply chains begets a limited comprehension of the intricate dynamics governing power relations, trust dynamics, and information-sharing mechanisms, all of which exert pivotal influence over sustainable outcomes. These factors serve as underlying determinants that shape the behavior and decision-making processes of supply chain participants, effectively acting as either facilitators or impediments to the advancement of sustainability initiatives. Lacking a comprehensive examination of these intricate interrelationships, the existing body
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of literature regrettably provides an incomplete and, in some ways, myopic depiction of the multifaceted factors that drive sustainability within the intricate tapestry of e-commerce supply chains.

Thus, the primary research gap that this study endeavors to bridge revolves around the discernible inadequacy in addressing the impact of interrelationships among e-commerce supply chain constituents on sustainability outcomes. Through an exhaustive investigation into the specific interactions and intricate dynamics governing relationships between manufacturers, suppliers, e-commerce platform operators, logistics providers, and consumers, this study aspires to fill this research void comprehensively. By doing so, it aims to make a substantial contribution to our collective understanding of the multifarious ways in which these interrelationships exert their influence on the overarching sustainability performance of e-commerce supply chains.

2.5. Research Questions

The research questions in this study are designed to address the specific objectives and explore the impact of interrelationships on supply chain sustainability in e-commerce. While the specific questions may vary based on the objectives of the study, some example questions could include:

1. How do the interrelationships between manufacturers and suppliers, including those from giant organizations in China, impact the sustainability outcomes of e-commerce supply chains?
2. What is the role of e-commerce platform operators, especially those from leading Chinese e-commerce platforms, in promoting sustainability, and how do they influence the sustainability outcomes of e-commerce supply chains?
3. To what extent do logistics providers, including those associated with major Chinese logistics companies, effectively implement sustainable practices, and how does it impact the sustainability outcomes of e-commerce supply chains?
4. How do consumer behavior and engagement, particularly in the context of Chinese consumers, influence the sustainability of e-commerce supply chains?

The research questions in this study have been meticulously designed to directly address our specific objectives, which revolve around exploring the intricate impact of interrelationships on sustainability within e-commerce. These questions serve as the cornerstone for our inquiry, guiding our investigation based on identified gaps in the existing literature. They also form the foundation for the in-depth interview questions posed to our respondents. These queries encompass critical dimensions of our study, from the influence of interrelationships between manufacturers and suppliers, especially those hailing from prominent Chinese organizations, to the pivotal role played by e-commerce platform operators, logistics providers associated with leading Chinese companies and the significant impact of consumer behavior and engagement, particularly within the context of Chinese consumers, on the sustainability of e-commerce supply chains.

3. Research Methods

This study adopts a qualitative research design to investigate the impact of interrelationships among e-commerce supply chain members on sustainability outcomes. Rich and contextual data were gathered through in-depth interviews with key stakeholders, including supply chain managers, sustainability managers, and executives. Thematic analysis was employed to identify recurring themes, patterns, and relationships, enabling a comprehensive understanding of the influence of interrelationships on sustainability in e-commerce supply chains. This research approach allows for a nuanced exploration of the complex dynamics and perspectives within the industry.

3.1. Research Design and Approach

This study employs a qualitative research approach to investigate the impact of interrelationships among e-commerce supply chain members on sustainability outcomes.
Qualitative research is chosen as it provides a deep and nuanced understanding of the complex dynamics and relationships within the supply chain network. The aim is to explore the subjective experiences, perspectives, and insights of key stakeholders involved in e-commerce supply chains.

In-depth interviews are conducted to gather rich and contextual data. This methodology allows for open-ended questioning and active engagement with participants, enabling them to share their thoughts, experiences, and perceptions in detail. It provides an opportunity to capture the complexities, nuances, and contextual factors that influence the impact of interrelationships on sustainability outcomes. Through in-depth interviews, researchers can explore the underlying mechanisms, motivations, challenges, and opportunities related to interrelationships in e-commerce supply chains. The interactive nature of interviews facilitates the exploration of participants’ beliefs, attitudes, decision-making processes, and understanding of sustainable practices within the supply chain context. Furthermore, qualitative research allows flexibility in adapting the research process based on emerging themes and insights. It enables researchers to probe deeper into specific areas of interest, follow up on participant responses, and explore unexpected or novel perspectives that may emerge during the interviews.

3.2. Demographics and Sample Selection

The participants in this study consist of key stakeholders involved in e-commerce supply chains, including suppliers, manufacturers, distributors, retailers, and customers. To ensure a comprehensive understanding of the topic, the study aims to include key stakeholders from prominent organizations in the e-commerce industry. These organizations, known for their significant market presence and impact on e-commerce supply chains, provide valuable insights into the interrelationships and their influence on sustainability outcomes. Participants were selected based on their roles, expertise, and experiences within the e-commerce supply chain, ensuring representation from different stages and sectors.

Participant selection was conducted between December 2022 to May 2023. The researchers employed a theoretical sampling approach to identify key stakeholders from prominent e-commerce companies. The selection process aimed to ensure representation from different stages and sectors of the e-commerce supply chain, allowing for a comprehensive understanding of the impact of interrelationships on sustainability outcomes. The first participant was selected based on geographical proximity to the researchers. Subsequent participants were selected through the reference of the previous respondents, adhering to the guiding principle of theoretical sampling in qualitative research. This approach helped ensure that a diverse range of perspectives and experiences were included in the study.

The demographics of the participants varied depending on their roles within the e-commerce supply chain. Factors such as company size, industry sector, geographic location, and level of involvement in sustainability practices may also be considered when selecting participants to ensure a comprehensive representation.

The sample size for qualitative research is typically smaller compared to quantitative studies, as the focus is on capturing rich, in-depth insights rather than generalizability. However, the sample size should be sufficient to ensure data saturation, where new information and themes stop emerging from the data. Therefore, for this study, a total of 35 participants were selected to provide their insights and perspectives on the impact of interrelationships among e-commerce supply chain members on sustainability outcomes. Table 1 provides a general overview of the participant demographics and their roles within the respective companies. The numerical values enclosed in parentheses inside the ‘Gender’ column indicate the total number of participants who were interviewed for each particular combination of role, gender, age range, and experience. In the initial row, it is indicated that two individuals holding the position of supply chain manager at Amazon were questioned. These individuals were identified as male and were both between the age range of 35–40. Additionally, they both possessed eight years of professional experience. The observed pattern is consistent across the entire table, wherein each grouping of parenthesis presents
a detailed breakdown of the number of participants based on the corresponding firm, role, gender, age range, and experience category.

<table>
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<tr>
<th>Company</th>
<th>Role</th>
<th>Gender</th>
<th>Age Range</th>
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<td>Production Manager</td>
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3.3. Perspectives Based on Participant Roles in Sustainability and Supply Chain Management

**Supply Chain Managers**

Supply Chain Managers may have a more comprehensive view of the overall supply chain and sustainability practices. They are likely to focus on supply chain efficiency, ensuring timely delivery of products, and the environmental and social aspects of sustainability as it relates to the entire supply chain.

**Procurement Managers**

Procurement Managers may be primarily concerned with sourcing and procurement processes. Their perspective revolves around responsible sourcing, supplier selection, and the sustainability of the materials and products they procure.

**Sustainability Managers**

Sustainability Managers are expected to prioritize sustainability practices. They may focus on environmental initiatives, certifications, and responsible sourcing. Their perspective is likely to be centered on integrating sustainability into the company’s operations.

**Production Managers**

Production Managers typically oversee manufacturing processes. They are concerned with optimizing production to minimize waste, energy consumption, and emissions, as well as ensuring that products are made in an environmentally responsible manner.

**Operations Executives**

Operations Executives oversee day-to-day operations. They mostly focus on the efficiency of logistics, transportation, and distribution, ensuring that operations align with sustainability goals.

3.4. Data Collection

In-depth interviews were conducted with the participants, including key stakeholders from giant organizations in China, to gather detailed insights into their experiences,
perspectives, and practices related to interrelationships and sustainability in e-commerce supply chains. The semi-structured interviews will allow for flexibility and exploration of emergent themes [110]. The interview questions were tailored to the research objectives and the specific role of each participant within the supply chain. These questions were developed based on a thorough review of relevant previous research in the field.

The aim and objectives of the study were clearly explained to the participants, emphasizing the importance of understanding the impact of interrelationships on sustainability outcomes in e-commerce supply chains. Participants were assured of confidentiality and privacy throughout the research process. The selection of participants focused on key stakeholders from prominent e-commerce companies in the Chinese marketplace, including Amazon, Inc., Alibaba Group Holding Ltd., Suning.com, Shein, and Wayfair. These companies were chosen due to their significant presence and influence in the e-commerce industry, as well as their sustainability initiatives. The in-depth interviews were conducted in English, as all participants were familiar with it. The interviews lasted approximately 35 to 55 min and followed a structured format. The use of in-depth interviews was considered ideal for eliciting a detailed understanding and capturing the nuances of participants’ perspectives on the impact of interrelationships on sustainability outcomes in e-commerce supply chains.

The researchers utilized a set of pre-developed questions to guide the interviews, ensuring consistency and enabling a comprehensive exploration of the research topic. The questions focused on various aspects, including the participants’ roles, experiences, challenges, and perceptions regarding interrelationships within the e-commerce supply chain and their impact on sustainability outcomes.

3.5. Ethical Considerations

The study adhered to ethical guidelines and protocols. Informed consent was obtained from all participants, ensuring they understood their participation’s purpose, procedures, and voluntary nature. Confidentiality and anonymity were maintained throughout the study, with all data being de-identified during analysis and reporting. The researchers prioritized the protection of participants’ privacy and ensured their rights were respected.

4. Results

Thematic analysis was employed to analyze the collected data. The data from interviews were transcribed, coded, and categorized to identify key themes and patterns related to interrelationships, sustainability, and their interplay. The analysis involved iterative processes of data immersion, coding, categorization, and interpretation. The transcripts and field notes were carefully reviewed and analyzed to identify recurring themes, relationships, and patterns within the data [111].

The data analysis identified commonalities and differences among the participants’ perspectives and experiences. Themes and sub-themes related to the impact of interrelationships on supply chain sustainability were developed. The analysis involved comparing and contrasting the responses from different participants and examining the connections between various aspects of interrelationships and sustainability outcomes. After conducting the analysis of the textual data from the 35 interviews, the codes and themes were organized using NVivo 12 software. This qualitative data analysis tool facilitated the systematic organization, exploration, and interpretation of the data. The software allowed the researchers to assign codes to segments of text, categorize them into themes, and establish connections between different codes and themes [112].

To ensure the accuracy and validity of the analysis, a cross-check was performed by comparing the coded data and themes with a word count analysis of the interview transcripts. This content analysis involved identifying the frequency of specific words and phrases in the text. The researchers used this word count analysis to verify the consistency and alignment of the prominent words with the major themes constructed during the analysis [113].
The software generated a word cloud, which visually represented the most frequently used words in the interview transcripts. The word cloud served as a visual aid to identify the dominant topics and concepts discussed by the participants [114]. Notably, the major themes constructed by the researchers and verified by experts aligned with the prominent words observed in the word cloud, further validating the findings and interpretations derived from the analysis.

The researchers engaged in reflexive practices to ensure rigor and validity, acknowledging their biases and assumptions throughout the data analysis process [115]. Peer debriefing and member-checking techniques were employed to validate the findings and interpretations with the participants. The researchers maintained an audit trail, documenting the decision-making processes and providing transparency in the data analysis process. Table 2 below provides a structured overview of the key themes and codes that emerged from our analysis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Themes</th>
<th>Frequency</th>
<th>Prioritization</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Manufacturers and Suppliers</td>
<td>Supplier Selection Criteria</td>
<td>High</td>
<td>1st</td>
</tr>
<tr>
<td></td>
<td>Responsible Sourcing Practices</td>
<td>Moderate</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>Transparency within the Supply Chain</td>
<td>High</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Collaboration on Sustainability Projects</td>
<td>Moderate</td>
<td>4th</td>
</tr>
<tr>
<td></td>
<td>Supplier Audits and Codes of Conduct</td>
<td>Low</td>
<td>6th</td>
</tr>
<tr>
<td></td>
<td>Challenges in Maintaining</td>
<td>Moderate</td>
<td>5th</td>
</tr>
<tr>
<td></td>
<td>Sustainable Interrelationships</td>
<td>Low</td>
<td>5th</td>
</tr>
<tr>
<td>B. E-commerce Platform Operators</td>
<td>Initiatives and Strategies</td>
<td>High</td>
<td>1st</td>
</tr>
<tr>
<td></td>
<td>Platform Features Promoting Sustainability</td>
<td>Moderate</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>Policies and Certifications</td>
<td>High</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Collaboration between Platform Operators and Sellers</td>
<td>Low</td>
<td>5th</td>
</tr>
<tr>
<td></td>
<td>Challenges in Fostering Sustainability</td>
<td>Moderate</td>
<td>4th</td>
</tr>
<tr>
<td>C. Logistics Providers</td>
<td>Green Logistics</td>
<td>Moderate</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Packaging Optimization</td>
<td>High</td>
<td>1st</td>
</tr>
<tr>
<td></td>
<td>Carbon Footprint Reduction</td>
<td>Low</td>
<td>4th</td>
</tr>
<tr>
<td></td>
<td>Sustainable Supply Chain Collaboration</td>
<td>High</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>Impact on Sustainability Outcomes</td>
<td>Low</td>
<td>5th</td>
</tr>
<tr>
<td>D. Consumer Behavior and Engagement</td>
<td>Consumer Awareness and Education</td>
<td>High</td>
<td>1st</td>
</tr>
<tr>
<td></td>
<td>Information on Sustainable Products</td>
<td>Moderate</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>Facilitating Sustainable Choices</td>
<td>High</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Consumer Preferences and Sustainability Practices</td>
<td>Low</td>
<td>4th</td>
</tr>
<tr>
<td></td>
<td>Challenges in Engaging Consumers</td>
<td>Moderate</td>
<td>5th</td>
</tr>
</tbody>
</table>

4.1. Unraveling Key Insights: A Comprehensive Data Analysis Process

The data analysis process for this study was conducted meticulously and aligned with the specific objectives of the research. The analysis followed a systematic approach, incorporating open, axial, and selective coding techniques to unravel key insights and develop meaningful themes. The following steps were undertaken in the data analysis process:

Open Coding: The researchers thoroughly examined the responses from the 35 interviews, meticulously evaluating each sentence to identify initial codes. Open coding fragmented the data into distinct parts, enabling a detailed assessment and comparison of responses across participants to identify potential relationships and differences [116]. A total of 43 open codes were identified, reflecting the diverse perspectives of the respondents.

Memos and Categorization: Throughout the open coding process, the researchers maintained memos, which played a vital role in supporting the categorization of the data.
Memos captured important insights, reflections, and potential themes concealed within the data. These memos aided in organizing the codes and identifying emerging patterns [117].

Axial and Selective Coding: Building upon the open coding phase, axial and selective coding techniques were employed to gain deeper insights and establish causal relationships. The diverse range of open codes was integrated into inter-related groups using the axial coding system.

Reliability and Validity: To ensure the reliability and validity of the codes, two coders conducted a thorough evaluation. The researchers closely examined participant responses, extracting themes identified during the open coding process.

NVivo Software: The analysis of the textual data, including the codes and themes, was conducted using NVivo software. This qualitative data analysis tool aided in organizing, exploring, and interpreting the data in a systematic and efficient manner. The software facilitated the management and visualization of the data, contributing to the overall analysis process.

4.2. Codes Generated from the Response of the Stakeholders

The analysis of stakeholder responses generated several codes that capture the key themes and insights related to the impact of interrelationships on sustainability outcomes in e-commerce supply chains. These codes provide a systematic way to organize and analyze the data, allowing for a comprehensive exploration of the research topic. Some of the codes identified include:

Assess the impact of interrelationships between manufacturers and suppliers on the sustainability outcomes of e-commerce supply chains

Supplier selection criteria: Stakeholders revealed their criteria for selecting suppliers, considering sustainability factors such as environmental performance, social responsibility, and ethical practices. They emphasize the importance of working with suppliers who align with their sustainability goals and have robust sustainability management systems.

Responsible sourcing practices: The findings shed light on how manufacturers and suppliers collaborate to ensure responsible sourcing of materials and components. Stakeholders share insights into traceability systems, certifications, and audits conducted to verify the sustainability credentials of their suppliers. They highlight the significance of working with suppliers who adhere to environmental regulations, respect human rights, and promote fair trade practices.

Transparency within the supply chain: Stakeholders emphasize the importance of transparency in the supply chain to promote sustainability. They discuss initiatives such as supplier engagement programs, supplier scorecards, and disclosure of supplier information to enhance transparency. Stakeholders also highlight the challenges of obtaining accurate and reliable sustainability data from suppliers and the need for collaborative efforts to overcome these challenges.

Collaboration on sustainability projects: Stakeholders share examples of collaborative sustainability projects undertaken with suppliers. These projects aim to jointly address sustainability challenges, such as reducing carbon emissions, improving energy efficiency, or promoting circular economy practices. The findings highlight the benefits of collaboration, including knowledge sharing, innovation, and leveraging combined resources to achieve sustainability goals.

Supplier audits and codes of conduct: Stakeholders stressed the importance of conducting regular supplier audits to assess compliance with sustainability standards and policies. They share insights into the audit processes, including assessment criteria, frequency, and corrective actions based on audit findings. Stakeholders also emphasize the significance of implementing supplier codes of conduct, which outline expected sustainability practices and serve as a framework for supplier engagement.

Challenges in maintaining sustainable interrelationships: The in-depth interviews address the challenges faced in maintaining sustainable interrelationships between manufacturers and suppliers. These challenges include ensuring compliance throughout the
supply chain, particularly concerning sustainability standards and regulations. Stakeholders highlight the need for effective communication, training, and capacity building to address these challenges. They also discuss resource availability constraints, particularly for smaller suppliers, and the importance of providing support and incentives to promote sustainable practices.

Examine the role of e-commerce platform operators in promoting sustainability and their influence on the sustainability outcomes of e-commerce supply chains

Initiatives and strategies: Stakeholders share insights into the initiatives and strategies implemented by e-commerce platform operators to encourage sustainable practices among sellers and buyers. They discuss the integration of sustainability into platform policies, guidelines, and seller agreements. Stakeholders also highlight the importance of providing sellers with resources, training, and support to enhance their sustainability performance.

Platform features promoting sustainability: The interviews shed light on specific platform features that promote sustainability within e-commerce supply chains. These features may include search filters for sustainable products, product labeling or certification systems indicating sustainability attributes, and user reviews highlighting sustainability-related aspects. Stakeholders emphasize the role of these features in empowering buyers to make sustainable choices and driving demand for sustainable products.

Policies and certifications: Stakeholders revealed the sustainability-related policies and certifications implemented by e-commerce platform operators. These include responsible packaging requirements, harmful material restrictions, or certifications for eco-friendly and fair-trade products. The findings explore the impact of these policies and certifications on seller behavior and the availability of sustainable options on the platform.

Collaboration between platform operators and sellers: Stakeholders share examples of collaboration between e-commerce platform operators and sellers to improve sustainability performance. These collaborations may involve sharing best practices, conducting training programs, or providing resources to sellers for adopting sustainable practices. Stakeholders highlight the positive outcomes of such collaborations, including increased awareness, improved product sustainability, and enhanced customer trust.

Challenges in Fostering Sustainability: The discussions address the challenges faced by e-commerce platform operators in promoting sustainability. These challenges may include ensuring seller compliance with sustainability standards, monitoring sustainability metrics and claims, and balancing sustainability objectives with convenience and cost considerations. Stakeholders emphasized the need for effective monitoring and enforcement mechanisms, clear communication, and education to overcome these challenges.

Evaluate the effectiveness of logistics providers in implementing sustainable practices and their impact on the sustainability outcomes of e-commerce supply chains

Green logistics: Stakeholders discuss the adoption of green logistics practices by logistics providers, such as optimizing transportation routes, using fuel-efficient vehicles, and implementing vehicle electrification or alternative fuel solutions. They highlight the reduction in greenhouse gas emissions, air pollution, and fuel consumption achieved through these practices. The discussions also explore the challenges and opportunities in implementing green logistics, such as infrastructure limitations, regulatory requirements, and the need for collaboration with transportation partners.

Packaging optimization: Stakeholders share insights into the efforts of logistics providers to optimize packaging within e-commerce supply chains. They discuss the use of sustainable packaging materials, right-sizing packaging to minimize waste, and implementing returnable or reusable packaging solutions. The discussions emphasize the reduction in material consumption, waste generation, and transportation costs resulting from packaging optimization. Stakeholders also highlight the importance of collaboration with manufacturers and e-commerce platform operators to drive sustainable packaging practices.

Carbon footprint reduction: The discussions evaluate the strategies employed by logistics providers to reduce their carbon footprint. Stakeholders share insights into carbon
footprint measurement and management practices, including the use of emissions tracking systems, carbon offset programs, and investments in renewable energy sources. They highlight the positive environmental impact achieved through carbon footprint reduction, such as lower greenhouse gas emissions and contributions to climate change mitigation. Stakeholders also discuss the challenges in measuring and reducing carbon emissions across the logistics network.

Sustainable supply chain collaboration: Stakeholders discuss the collaboration between logistics providers, manufacturers, and e-commerce platform operators to implement sustainable practices across the supply chain. They share examples of joint initiatives, such as supplier engagement programs, shared transportation networks, and collaborative sustainability projects. The discussions highlight the benefits of collaboration, including improved efficiency, reduced environmental impact, and enhanced sustainability performance throughout the e-commerce supply chain.

Impact on sustainability outcomes: The discussions evaluate the overall impact of sustainable practices implemented by logistics providers on the sustainability outcomes of e-commerce supply chains. Stakeholders assess the reduction in environmental footprint, improvement in resource efficiency, and contribution to social and economic sustainability achieved through these practices. They also explore the potential for cost savings, customer satisfaction, and competitive advantage resulting from sustainable logistics operations.

Investigate the influence of consumer behavior and engagement on the sustainability of e-commerce supply chains

Consumer awareness and education: Stakeholders discuss the importance of educating consumers about sustainability issues and their impact on e-commerce supply chains. They share insights into awareness campaigns, educational materials, and communication strategies to inform consumers about the environmental and social implications of their purchasing decisions. The discussions highlight the role of consumer awareness in driving demand for sustainable products and services and fostering sustainable behaviors.

Information on sustainable products: Stakeholders discuss the strategies employed to provide consumers with information on sustainable products within e-commerce platforms. They explore initiatives such as eco-labeling, product certifications, and transparency in supply chain information. The discussions emphasize the significance of clear and accessible information to enable informed choices and encourage consumers to prioritize sustainability when making purchasing decisions.

Facilitating sustainable choices: The discussions explore strategies for facilitating sustainable choices during online shopping experiences. Stakeholders share insights into the design of user interfaces, search filters, and product recommendations that promote sustainable options. They discuss features such as highlighting sustainable alternatives, providing sustainability ratings, and enabling comparison of environmental attributes. The discussions highlight the potential for e-commerce platforms to influence consumer choices and steer demand toward more sustainable products.

Consumer preferences and sustainability practices: Stakeholders examine how consumer preferences, such as the demand for eco-friendly products, influence the sustainability practices of e-commerce businesses. They discuss the responsiveness of businesses to consumer demands and their efforts to align product offerings with sustainable preferences. The discussions also explore the challenges faced in balancing sustainability with price, convenience, and other consumer expectations.

Challenges in engaging consumers: The discussions address the challenges of engaging consumers in sustainable behaviors within e-commerce supply chains. Stakeholders discuss the need for clear and compelling communication to convey the sustainability benefits of products and services. They also explore barriers to adoption, such as consumer attitudes, lack of awareness, and perceived trade-offs between sustainability and convenience or affordability. Stakeholders highlight the importance of addressing these challenges to foster the widespread adoption of sustainable behaviors.
5. Discussion

The following discussion section presents a critical synthesis and comparison of the primary data with the literature, aiming to interpret and describe the significance of our findings in relation to the research problem and provide new understanding and insights that emerged from our research on sustainability in e-commerce supply chains. Stakeholders highlighted the importance of aligning with sustainability goals and implementing robust sustainability management systems when selecting suppliers. These findings are consistent with prior research [118–120] that emphasized the need for sustainable supplier selection criteria. Our study expands upon this by uncovering the significance of responsible sourcing practices, such as traceability systems, certifications, and audits, in verifying the sustainability credentials of suppliers. This adds to the existing literature on supplier evaluation and highlights the evolving nature of sustainability practices within supply chains [121,122]. Furthermore, our findings revealed challenges related to obtaining accurate and reliable sustainability data from suppliers. This aligns with the literature [123–125] that discusses the difficulties in accessing transparent and reliable sustainability information from suppliers. It emphasizes the need for collaborative efforts to overcome these challenges, indicating a gap that future research can explore in developing effective data-sharing mechanisms.

Our results show that sustainable interrelationships between manufacturers and suppliers are crucial for achieving sustainability outcomes in e-commerce supply chains. Lessons learned include the need for compliance throughout the supply chain, effective communication, training, capacity building, and providing support and incentives to promote sustainable practices [126]. These insights can inform practitioners and policymakers in formulating guidelines and best practices for establishing sustainable interrelationships within supply chains. Our interviews revealed the initiatives and strategies implemented by e-commerce platform operators to encourage sustainable practices among sellers and buyers. These findings align with previous studies [127,128] that emphasized the importance of integrating sustainability into platform policies and guidelines. However, our research provides a deeper understanding of specific platform features, such as search filters for sustainable products, product labeling or certification systems, and user reviews, which empower buyers to make sustainable choices. These findings contribute to the existing literature by shedding light on the mechanisms through which platform operators can influence consumer behavior and drive demand for sustainable products [129–131].

Furthermore, our study identified challenges faced by e-commerce platform operators in fostering sustainability, such as ensuring seller compliance with sustainability standards and balancing sustainability objectives with convenience and cost considerations. This supports prior research [132,133], highlighting the complexities associated with implementing and monitoring sustainability practices within e-commerce platforms. Our findings emphasize the need for effective monitoring and enforcement mechanisms, clear communication, and education to overcome these challenges.

In light of our results, we can deduce that e-commerce platform operators play a pivotal role in promoting sustainability within e-commerce supply chains. Lessons learned include the importance of integrating sustainability into platform policies, providing resources and support to sellers, and implementing features that facilitate sustainable choices for consumers. These insights can guide platform operators in enhancing their sustainability strategies and contribute to the development of guidelines for sustainable e-commerce practices.

Findings also provided insights into various sustainable practices implemented by logistics providers and their impact on e-commerce supply chains. Our findings corroborate existing research [134,135] that emphasizes the importance of green logistics practices, such as optimizing transportation routes and using fuel-efficient vehicles. However, our study delves deeper into the collaborative efforts between logistics providers, manufacturers, and e-commerce platform operators in implementing sustainable practices across the supply chain. This highlights the significance of joint initiatives, shared transportation networks,
and collaborative sustainability projects in achieving improved efficiency, reduced environmental impact, and enhanced sustainability performance throughout the e-commerce supply chain.

Additionally, our research identified the optimization of packaging within e-commerce supply chains as a crucial aspect of sustainable logistics. The use of sustainable packaging materials, right-sizing packaging, and implementing returnable or reusable packaging solutions emerged as effective strategies. These findings align with prior studies [136,137] and highlight the importance of collaborative efforts between logistics providers, manufacturers, and e-commerce platform operators in driving sustainable packaging practices.

Based on our results, we can deduce that logistics providers’ sustainable practices positively contribute to the sustainability outcomes of e-commerce supply chains. Lessons learned include the adoption of green logistics practices, optimization of packaging, and collaborative efforts across the supply chain. These insights can guide logistics providers in implementing sustainable practices and inform policymakers in developing regulations and incentives to encourage sustainability in logistics operations.

Furthermore, the findings shed light on the significant role of consumer awareness and education in driving sustainability within e-commerce supply chains. Our findings align with existing research [138,139], emphasizing the importance of informing consumers about the environmental and social implications of their purchasing decisions. We expanded upon this by exploring strategies employed by e-commerce platforms to provide consumers with information on sustainable products. The use of eco-labeling, product certifications, and transparency in supply chain information emerged as effective tools to enable informed choices and encourage consumers to prioritize sustainability.

Moreover, our study examined the responsiveness of e-commerce businesses to consumer demands for eco-friendly products. We found that businesses increasingly align their product offerings with sustainable preferences to meet consumer expectations. These findings contribute to the existing literature by highlighting the influence of consumer preferences on the sustainability practices of e-commerce businesses [140,141]. However, our research also uncovered challenges in engaging consumers in sustainable behaviors within e-commerce supply chains. Overcoming perceived trade-offs between sustainability and convenience or affordability, addressing consumer attitudes, and increasing awareness were identified as key challenges. These findings support prior research [142,143] that discusses the complexities associated with changing consumer behaviors and the need for targeted communication strategies.

From our results, we can deduce that consumer behavior and engagement play a pivotal role in shaping the sustainability of e-commerce supply chains. Lessons learned include the importance of consumer awareness, providing information on sustainable products, and designing user interfaces that promote sustainable choices. These insights can guide e-commerce platforms in developing strategies to encourage sustainable consumer behavior and inform stakeholders about the role they can play in fostering sustainability [144]. This research revealed valuable insights into sustainable practices and their significance in achieving sustainability outcomes. The findings support and expand upon prior research, providing a deeper understanding of the complexities and opportunities in promoting sustainability within e-commerce supply chains. Our primary data analysis allows us to explain the results, highlighting both expected and unexpected findings, unusual patterns, and emerging trends. By comparing our results with previous research, we have established connections and provided a context for our findings.

Overall, our study contributes to the existing knowledge by providing a critical synthesis and comparison of primary data with the literature, focusing on the four objectives of assessing the impact of interrelationships between manufacturers and suppliers, examining the role of e-commerce platform operators, evaluating the effectiveness of logistics providers, and investigating consumer behavior and engagement in promoting sustainability within e-commerce supply chains.
6. Conclusions

This study has explored and analyzed the key factors influencing the sustainability outcomes of e-commerce supply chains from the perspectives of various stakeholders, including manufacturers, suppliers, e-commerce platform operators, logistics providers, and consumers. The discussions and insights generated by these stakeholders have provided a comprehensive understanding of the interrelationships and dynamics within the supply chain that impact sustainability. The findings highlight the importance of sustainable supplier relationships in promoting sustainability within e-commerce supply chains. Stakeholders emphasized the significance of supplier selection criteria, responsible sourcing practices, transparency, collaboration on sustainability projects, supplier audits, and codes of conduct. These factors contribute to the overall sustainability performance of the supply chain by ensuring adherence to sustainability goals, promoting ethical practices, and driving innovation toward sustainability.

Furthermore, the study has identified the role of e-commerce platform operators in promoting sustainability and their influence on the sustainability outcomes of e-commerce supply chains. Stakeholders discussed initiatives and strategies implemented by platform operators; the platform features promoting sustainability, policies, certifications, and collaboration with sellers. These efforts contribute to creating an enabling environment for sustainable practices, empowering consumers to make informed and sustainable choices, and driving demand for sustainable products.

The study also evaluated the effectiveness of logistics providers in implementing sustainable practices and their impact on the sustainability outcomes of e-commerce supply chains. Stakeholders emphasized the adoption of green logistics practices, packaging optimization, carbon footprint reduction, and collaborative efforts across the supply chain. These practices result in a reduced environmental footprint, improved efficiency, and enhanced sustainability performance throughout the logistics network.

Additionally, the study investigated the influence of consumer behavior and engagement on the sustainability of e-commerce supply chains. Stakeholders highlighted the importance of consumer awareness and education, providing information on sustainable products, facilitating sustainable choices, and understanding consumer preferences. Engaging consumers in sustainable behaviors poses challenges, such as communication, barriers to adoption, and trade-offs between sustainability and convenience or affordability. Overcoming these challenges is crucial to foster the widespread adoption of sustainable consumer behaviors.

The research underscores the significance of sustainable supplier relationships, highlighting criteria, responsible sourcing practices, transparency, collaboration, audits, and codes of conduct as key drivers of sustainability. Moreover, it explores the uncharted territory of e-commerce platform operators’ efforts to create an environment conducive to sustainability and logistics providers’ adoption of green practices. Additionally, the study delves into the pivotal role of consumer behavior and engagement, shedding light on the challenges and opportunities in promoting sustainable choices. In doing so, it advances the field by providing a comprehensive and multifaceted understanding of sustainability in e-commerce supply chains, offering valuable insights for future research and practice.

6.1. Theoretical Implications

The theoretical implications of this study are significant in advancing the understanding of SSCM and RDT in the context of e-commerce supply chains. By integrating these theories, the study provides theoretical foundations and practical insights for supply chain managers, policymakers, and industry practitioners. Firstly, the study demonstrates the relevance of SSCM in managing sustainability in e-commerce supply chains. SSCM emphasizes the integration of environmental, social, and economic dimensions into supply chain practices and promotes collaboration and coordination among stakeholders. The findings of this study align with the principles of SSCM by highlighting the importance of stakeholder engagement, life cycle perspective, supplier relationships, and collaboration for
achieving sustainability goals [145,146]. By adopting the principles of SSCM, organizations can effectively manage the environmental impact of e-commerce activities, promote social responsibility, and align their operations with sustainable practices.

Secondly, the study incorporates the concepts of resource dependency and power dynamics from RDT to understand the interrelationships among supply chain members. RDT recognizes that organizations are mutually dependent on external resources controlled by other organizations. The study sheds light on power imbalances within e-commerce supply chains and their influence on collaboration, information sharing, and decision-making processes [147]. Supply chain managers can navigate inter-organizational relationships more effectively by understanding power dynamics and resource dependencies and promoting sustainable practices through collaboration and coordination.

Furthermore, the study highlights the importance of consumer behavior and engagement in driving sustainability outcomes in e-commerce supply chains. It emphasizes the role of consumer awareness, education, and access to information on sustainable products. By considering consumer preferences and facilitating sustainable choices, e-commerce platforms can influence consumer behavior and steer demand toward more sustainable options. This understanding contributes to the theoretical framework of consumer engagement and provides insights into strategies for fostering sustainable behaviors among consumers [148].

6.2. Managerial Implications

The findings of this study have several important managerial implications for supply chain managers in the e-commerce industry. These implications are based on the key factors influencing the sustainability outcomes of e-commerce supply chains, as identified by the study:

Supplier Relationship Management: Supply chain managers should prioritize the establishment and maintenance of sustainable supplier relationships. This involves selecting suppliers based on sustainability criteria, such as environmental performance, social responsibility, and ethical practices. It is important to work with suppliers who align with the organization’s sustainability goals and have robust sustainability management systems in place. Regular supplier audits should be conducted to assess compliance with sustainability standards and policies, and supplier codes of conduct should be implemented to outline expected sustainability practices.

Collaboration and Partnerships: Collaboration among supply chain members is crucial for driving sustainability in e-commerce supply chains. Supply chain managers should actively seek opportunities for collaboration with suppliers, e-commerce platform operators, and logistics providers. Collaborative sustainability projects can be undertaken to jointly address sustainability challenges, such as reducing carbon emissions or promoting circular economy practices. Collaboration enables knowledge sharing, innovation, and leveraging of combined resources to achieve sustainability goals.

E-commerce Platform Sustainability: E-commerce platform operators play a significant role in promoting sustainability within e-commerce supply chains. Supply chain managers should collaborate with platform operators to integrate sustainability into platform policies, guidelines, and seller agreements. This includes implementing initiatives such as search filters for sustainable products, eco-labeling systems, and transparency in supply chain information. By working together, supply chain managers and platform operators can create an enabling environment for sustainable practices and drive demand for sustainable products.

Green Logistics and Packaging Optimization: Logistics providers have a crucial role in implementing sustainable practices in e-commerce supply chains. Supply chain managers should encourage logistics providers to adopt green logistics practices, such as optimizing transportation routes, using fuel-efficient vehicles, and implementing packaging optimization strategies. Collaboration with logistics providers, manufacturers, and e-
commerce platform operators is essential to drive sustainable packaging practices and reduce the environmental impact of logistics operations.

Consumer Engagement: Supply chain managers should focus on engaging consumers in sustainable behaviors within e-commerce supply chains. This involves raising consumer awareness about sustainability issues and their impact on supply chains. Providing clear and accessible information on sustainable products, such as through eco-labeling and product certifications, can help consumers make informed choices. Designing user interfaces, search filters, and product recommendations that promote sustainable options can also facilitate sustainable choices during the online shopping experience.

Overcoming Challenges: Supply chain managers should address the challenges identified in the study, such as ensuring compliance throughout the supply chain, communicating sustainability benefits effectively, and overcoming barriers to consumer adoption of sustainable behaviors. This may involve implementing effective monitoring and enforcement mechanisms, improving communication strategies, and educating consumers about the environmental and social implications of their purchasing decisions.

6.3. Limitations of the Study

Before charting a course for future research in the domain of sustainability within e-commerce supply chains, it is essential to acknowledge and comprehend the inherent limitations of the current study. These constraints not only provide insights into the boundaries of the existing research but also point toward unexplored territories deserving of scholarly attention.

Firstly, the study’s geographical focus might be considered somewhat limited, potentially excluding the diversity of regional nuances and unique sustainability challenges that characterize different e-commerce markets worldwide. This limitation highlights the need for future research to adopt a more expansive and inclusive approach, encompassing a wider array of geographical contexts to unravel the full spectrum of sustainability dynamics across the globe. Secondly, the study’s primary reliance on qualitative methods, particularly in-depth interviews, introduces the possibility of bias stemming from participant self-reporting. While qualitative methods offer an invaluable depth of understanding, diversifying the methodological toolkit by incorporating quantitative approaches, surveys, observational data, or secondary data analysis could enrich the research landscape, providing a more holistic view of sustainability within e-commerce supply chains. Lastly, sustainability is a dynamic field that continuously adapts to emerging challenges and opportunities. The study, framed within a specific timeframe, offers a snapshot of sustainability practices and challenges, potentially missing the evolving nature of sustainability in e-commerce supply chains. To capture this evolution, future research might consider longitudinal studies, allowing for a more comprehensive understanding of sustainability trends and their implications over time.

6.4. Ideas for Future Research

While the study provides valuable insights into the sustainability outcomes of e-commerce supply chains, several areas could be explored in future research to further advance our understanding and address emerging challenges. Here are some ideas for future research:

Circular Economy in E-commerce Supply Chains: Investigate the implementation and impact of circular economy principles in e-commerce supply chains. Explore how e-commerce platforms, manufacturers, suppliers, and logistics providers can collaborate to facilitate product reuse, recycling, and resource recovery. Analyze the potential environmental and economic benefits of adopting circular economy practices in e-commerce.

Sustainable Last-Mile Delivery: Examine the sustainability challenges and opportunities associated with last-mile delivery in e-commerce supply chains. Investigate innovative delivery models, such as crowd-shipping, drone delivery, and electric vehicles, and their
potential to reduce carbon emissions and improve delivery efficiency. Assess consumer perceptions and behaviors towards sustainable last-mile delivery options.

Social Impact of E-commerce: Explore the social dimensions of e-commerce supply chains and their impact on stakeholders. Investigate the working conditions of gig economy workers and delivery personnel in the e-commerce sector. Assess the social implications of e-commerce on local communities, including issues related to employment, inequality, and displacement of traditional retail businesses.

Sustainable Packaging Innovations: Investigate emerging packaging technologies and innovations that can enhance the sustainability of e-commerce supply chains. Explore the use of biodegradable and compostable materials, smart packaging solutions, and packaging optimization strategies. Assess the environmental impact, consumer acceptance, and economic feasibility of these packaging innovations.

Data Analytics for Sustainable Supply Chains: Examine the role of data analytics and advanced technologies, such as artificial intelligence and blockchain, in promoting sustainability in e-commerce supply chains. Investigate how data-driven insights can help optimize supply chain operations, improve transparency and traceability, and reduce environmental impacts. Assess the potential challenges and ethical considerations associated with data analytics in SSCM.

Consumer Behavior and Sustainable Consumption: Deepen the understanding of consumer behavior and decision-making processes related to sustainable consumption in e-commerce. Investigate the factors influencing consumers’ adoption of sustainable practices, such as green product attributes, eco-labeling, pricing strategies, and convenience factors. Explore interventions and strategies to promote sustainable consumption behaviors in the e-commerce context.

Governance and Regulation of E-commerce Supply Chains: Examine the role of governance mechanisms and regulatory frameworks in promoting sustainability in e-commerce supply chains. Investigate the effectiveness of government policies, industry standards, and certification schemes in driving sustainable practices. Assess the challenges and opportunities of implementing and enforcing sustainability regulations in the e-commerce sector.

Author Contributions: S.S. (Stavros Sindakis) contributed significantly to the conception and design of the research project, playing a pivotal role in shaping the study’s objectives and methodology. As the corresponding author, he oversaw the data collection process, including coordinating in-depth interviews with key stakeholders involved in e-commerce supply chains. Additionally, he led the thematic analysis of the gathered data, offering expert insights into the interpretation of the findings. S.S. (Stavros Sindakis) also drafted the manuscript, ensuring the cohesive integration of the research’s key insights and implications. His expertise in supply chain sustainability, qualitative research, and SSCM was vital in providing valuable insights and ensuring the study’s overall rigor. S.S. (Saloome Showkat) was instrumental in the data collection process, assisting in conducting in-depth interviews with key stakeholders within e-commerce supply chains. Her contributions during the thematic analysis phase provided critical perspectives, enriching the data interpretation and identifying key themes related to interrelationships among supply chain members. Additionally, S.S. (Saloome Showkat) actively participated in refining the manuscript, offering her insights and expertise in the field of sustainability. J.S. contributed to the research project by assisting in identifying and selecting relevant stakeholders for the in-depth interviews. His expertise in the e-commerce industry and supply chain management proved valuable during data collection, enabling the team to gather comprehensive and pertinent information. Moreover, J.S. played an essential role in reviewing and revising the manuscript, ensuring clarity in the presentation of results and the practical implications of the study. Collectively, the authors collaborated closely throughout the entire research process, from conception to manuscript preparation, each bringing their unique expertise to the study. Their joint efforts resulted in this qualitative exploration of the impact of interrelationships on supply chain sustainability within the e-commerce industry. All authors have read and agreed to the published version of the manuscript.

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