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Adopting Circular Economy Principles: How Do Conflict Management Strategies Help Adopt Smart Technology in Jordanian SMEs?

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Abstract: Smart technology is essential for integrating circular economy principles. This research investigates how conflict management strategies (collaboration, accommodation, avoidance, compromise, and competition) impact the adoption of smart technology, particularly blockchain, in Jordanian SMEs. Additionally, the study explores the moderating role of customer-centric green supply chain management in the relationship between blockchain adoption and circular economy principles. This research addresses a gap in the literature by focusing on Jordanian SMEs, an under-explored context. Data were collected from 421 senior managers, department heads, and executives of Jordanian SMEs, and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), to test the hypotheses and analyze complex relationships. The findings reveal that conflict management strategies are critical in blockchain adoption, with collaboration and compromise emerging as the most influential. Moreover, blockchain adoption positively impacts the implementation of circular economy principles. The moderating effect of customer-centric green supply chain management enhances the sustainability and competitiveness of SMEs through blockchain technology. This research contributes to theory and practice by providing valuable insights into the strategic role of conflict management in driving technological innovation and sustainability within the circular economy framework, particularly in the context of Jordanian SMEs.

Keywords: circular economy principles; blockchain adoption; conflict management strategies; customer-centric GSCM; Jordan; small and medium-sized enterprises (SMEs); green supply chain management

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1. Introduction

Despite the recognized benefits of blockchain technology for small and medium-sized enterprises (SMEs), research on its adoption within the framework of circular economy principles, particularly among Jordanian SMEs, remains limited [1,2]. While the increasing focus on circular economy principles in modern businesses encourages investment in smart technologies like blockchain to enhance resource efficiency and environmental sustainability [1], the role of conflict management in the successful integration of these technologies has been largely overlooked. This study addresses this gap by investigating the impact of various conflict management strategies on blockchain adoption among Jordanian SMEs, aiming to provide valuable insights into leveraging this technology for sustainable development.

SMEs play a vital role in most economies, driving innovation, creating jobs, and contributing significantly to economic growth. Blockchain technology offers SMEs numerous advantages, including improved supply chain management, enhanced data security, increased operational efficiency, and a stronger competitive edge [3,4]. By facilitating secure and transparent transactions, blockchain technology can also promote sustainable practices and contribute to the implementing circular economy principles.

Despite the potential benefits, adopting blockchain technology is not without its challenges. Resistance to change, implementation complexity, concerns over cost, and a lack of understanding of the technology can create conflicts among stakeholders [5,6]. These conflicts can significantly impede the successful integration of blockchain technology within SMEs [7]. Therefore, effective conflict management strategies are crucial for navigating the complexities of blockchain adoption. By facilitating stakeholder engagement, consensus-building, and organizational change, conflict management can help address the challenges and uncertainties associated with adopting new technologies.

This study focuses specifically on Jordanian SMEs due to their unique characteristics and importance to the national economy. SMEs account for 95% of all registered firms in Jordan, contributing more than half of the GDP and employing more than 60% of the workforce [8]. However, Jordanian SMEs face significant challenges in technology adoption due to limited resources, a lack of technology infrastructure, and insufficient awareness [8,9].

Recent studies have extensively explored the technical aspects and potential applications of blockchain adoption in SMEs, emphasizing the critical role of blockchain technologies in improving transparency, traceability, and sustainability in business operations. Research by Shqair and Altarazi [8] highlights the unique challenges SMEs face in adopting Industry 4.0 technologies, particularly in Jordan, where limited financial resources, technological infrastructure, and government support further compound these challenges. Similarly, studies by Shareef, Dwivedi [10], Angraal, Krumholz [11], Crosby, Pattanayak [12] have delved into the transformative potential of blockchain across various sectors, underscoring its role in decentralizing data management and enhancing transparency.

Despite the growing body of research on blockchain technology, there remains a significant gap in understanding its human and organizational dimensions, especially within the context of SMEs in developing countries like Jordan [13]. Much of the existing literature has focused on large corporations or tech-centric sectors [14,15], leaving a void in how SMEs, with their unique dynamics and constraints, navigate the challenges of adopting advanced technologies.

Previous studies have affirmed that conflicts during technological adoption can significantly impede progress, making the application of conflict management strategies crucial for the successful integration of blockchain technology in SMEs [13,16]. However, the existing literature largely overlooks how these technologies can be effectively integrated with conflict management strategies to promote sustainable practices in SMEs. This gap is particularly pronounced in the socio-economic context of Jordan, where targeted interventions are needed to help SMEs adopt smart technologies while adhering to circular economy principles, thereby fostering sustainable business practices and economic growth in the region.

It is at this juncture that effective conflict management strategies become crucial. Understanding and applying appropriate conflict management strategies is essential for the successful integration of blockchain technology in SMEs [16]. The importance of conflict management in organizational change is widely acknowledged in the literature [16,17]. However, its specific application in the adoption of smart technology by SMEs remains understudied. Existing literature provides a limited understanding of the role of different conflict management strategies in the smart technology adoption process within SMEs. This gap is particularly significant concerning Jordanian SMEs, where societal, economic, and organizational influences play a crucial role in transforming business practices through technological changes [6].

Recent calls from researchers Elhidaoui, Benhida [18] and Mohamed, Haddad [19] have highlighted the need to examine the relationship between smart technologies, such as blockchain and sustainable practices. Additionally, Corsini, Gusmerotti [20] have emphasized the connection between blockchain and prosperity benefits, while Hassan, Khan [1] have called for examining circular economy principles as an outcome variable. Similarly, Khan, Mubarik [21] have called for an exploration of behaviors and green supply

chain practices related to blockchain adoption and their impact on organizational performance management and sustainability. Agabe [22] underscores the importance of selecting strategies that promote harmony within organizations and improving the necessary skills and techniques to identify, manage, and resolve conflicts constructively. Future studies are suggested to explore conflict management styles across different industries and cultural contexts with larger sample sizes to generalize findings, as recommended by ALHAMOUD [23].

This study investigates how conflict management strategies impact blockchain adoption, explores the moderating role of customer-centric green supply chain management, and analyzes the impact of blockchain adoption on circular economy principles within Jordanian SMEs. Specifically, the research seeks to achieve the following.

1. Identify and analyze the specific effects of five distinct conflict management strategies (collaboration, accommodation, avoidance, compromise, and competition) on the blockchain adoption technology among Jordanian SMEs;
2. Investigate the impact of blockchain adoption on the successful implementation of circular economy principles in Jordanian SMEs;
3. Assess the moderating role of customer-centric green supply chain management (GSCM) in the relationship between blockchain adoption and the implementation of circular economy principles.

By addressing this gap, the study provides valuable insights for managers, policymakers, and academics on how to effectively leverage blockchain for sustainable development in a critical economic sector within the unique organizational culture and business environment of Jordan.

Drawing on Stakeholder Theory and the Technology Acceptance Model (TAM), this study examines how addressing stakeholder concerns through effective conflict management can promote blockchain adoption [24,25]. Stakeholder Theory guides the examination of how different conflict management strategies address stakeholder concerns during blockchain adoption, while TAM provides a framework for understanding how the perceived usefulness and ease of use of blockchain influence its acceptance. By integrating these theoretical lenses, the research develops a framework for understanding how individual-level conflict management strategies influence organizational-level technology adoption and the implementation of circular economy principles, understanding the study's contribution to both conflict management and technological innovation within SMEs.

Overall, this study contributes to a better understanding of the human and organizational factors that affect SMEs' technological adoption within Customer-Centric Green Supply Chain Management (CCGSCM), providing new insights into aligning blockchain technology with circular economy principles.

2. Literature Review

2.1. Conflict Management Strategies (CMS)

Conflict management is critical in organizational settings [26], especially when implementing new technologies or pursuing sustainability initiatives like the circular economy. Since the 1960s, various researchers have proposed strategies to manage conflicts, most of which are based on the managerial grid developed by Robert R. Blake and Jane Mouton. This grid represents two axes: "concern for people" and "concern for task," illustrating how the interplay between task orientation and relationship orientation influences interactions with others [27].

In the 1970s, Kenneth Thomas and Ralph Kilmann introduced a two-dimensional model, including assertiveness and cooperativeness, resulting in the five different strategies: competing, avoiding, accommodating, collaborating, and compromising, ensuring productive communication in an individual's approach [28]. Building upon the existing foundation, Rahim developed the Rahim Organizational Conflict Inventory (ROCI), specifically designed to measure conflict management styles within organizational settings [29].

The dual concerns model of conflict management, proposed by Pruitt and Rubin, provides a comprehensive framework by considering two dimensions: concern for self and concern for others. This model also identifies five similar conflict management strategies, aligning closely with the frameworks proposed by Thomas and Kilmann and Rahim, reinforcing the robustness of these approaches. Moreover, this model proposes that effective conflict management requires the balance between self and concern for others [30,31].

To further enhance the understanding of conflict management in diverse organizational contexts, this research integrates Ting-Toomey and Qetzel's Culture-Based Social Ecological Conflict Model (CBSECM). CBSECM provides a meta-theoretical framework to understand conflict in a social-ecological context, integrating cultural and ecological perspectives and emphasizing the interplay among individual behaviors, organizational practices, and broader environmental contexts [32]. This model is particularly relevant for analyzing how conflict management strategies at the individual level impact organizational outcomes and system-level sustainability goals [32].

Rahim Rahim's (1983) Conflict Management Styles Inventory refines and builds upon the foundational models of Thomas and Kilmann and Pruitt and Rubin and integrates insights from Ting-Toomey and Oetzel's Culture-Based Social Ecological Conflict Model (CBSECM). Rahim's model provides a more applied and specific approach, particularly suited to organizational contexts. This comprehensive framework allows us to examine how different conflict management strategies influence blockchain adoption and the implementation of circular economy principles in Jordanian SMEs, driving organizational-level technological adoption and system-level sustainability practices [29].

To illustrate these strategies, a brief overview of the five key conflict management approaches is provided. Collaboration (CL) is a strategy wherein parties work together to achieve mutually beneficial solutions, characterized by high assertiveness and cooperativeness [33]. Leveraging emotional intelligence, collaboration effectively fosters win–win outcomes and encourages innovation through joint problem-solving [34,35].

In contrast, Accommodation (AC) involves prioritizing another's viewpoint, often at one's own expense [36]. This strategy is marked by high cooperativeness and low assertiveness, making it effective for maintaining relationships, especially when the issue is more significant to the other party [37].

Avoidance (AV) refers to sidestepping a conflict, which leaves both parties' concerns unaddressed. Vallone, Dell'Aquila [38] noted that avoidance reflects low assertiveness and cooperativeness. This strategy can be appropriate when a conflict is minor or when further information is required [39].

Compromise (CM) seeks to find a middle ground where each party concedes some of their demands. This strategy strikes a balance between assertiveness and cooperativeness [40] and is particularly favored in interpersonal conflicts as an effective resolution approach [39].

Lastly, Competition (CP) is characterized by an assertive stance aimed at winning a conflict at another's expense [36]. It is often employed when one's rights or principles are threatened. However, ref. [41] revealed that competitive strategies could adversely affect organizational performance if not managed properly, highlighting the need for careful consideration in stakeholder interactions.

This investigation contributes to a deeper understanding of how conflict management strategies can drive technological adoption and sustainable practices within organizations.

2.2. Smart Technology Adoption with a Focus on Blockchain

The adoption of new technology has evolved significantly since its inception, primarily associated with the cryptocurrency Bitcoin [42]. The integration of networked devices and systems, such as the Internet of Things (IoT), artificial intelligence (AI), blockchain, and big data analytics, enables businesses to become smarter and more efficient, facilitating predictive maintenance in manufacturing [43]. However, the complex nature of smart technology ecosystems, security vulnerabilities, data privacy concerns, and geopolitical disturbances

necessitates proactive conflict management strategies to ensure efficient operations and reduce risks [44].

Blockchain is a decentralized and secure distributed ledger technology key for trust and transparency in supply chains [12]. Its applications extend beyond finance to sectors like health care and e-government [11]. Blockchain enhances supply chain transparency and accountability, aligning with circular economy principles [45]. Initially viewed with skepticism due to its complexity, blockchain technology has gradually gained recognition for its potential beyond financial applications, becoming a subject of burgeoning research across various sectors [12,46]. These features collectively ensure the integrity and transparency of data. In this way, blockchain technology is a smart technology considered to be a powerful tool for various applications [47,48].

Examining the connection between this emerging technology and conflict management will provide valuable insights into the potential advantages of implementing these emerging technologies [49]. Its integration within supply chains indicates a paradigm shift toward increased transparency and efficiency [19]. Blockchain's ability to provide an unalterable record of transactions ensures traceability and accountability, which are key factors in managing supply chain complexities [50,51]. The technology's capacity to track the life cycle of products and materials aligns seamlessly with circular economy principles and sustainable supply chain practices [45,52].

The novel and complex nature of this technology creates multiple barriers concerning its operation and understanding [5]. SMEs tend to be more flexible and innovative compared to larger organizations. However, the rapid evolution of blockchain, especially in finance, necessitates continuous adaptation to technological advancements [53]. This is especially true in the case of SMEs, as they are more vulnerable to the risks of not adopting advanced technology and lack sufficient resources [1]. Firms outside the technology sector often recognize their lack of knowledge regarding blockchain technology, creating conflicts among stakeholders regarding the adoption of the technology [54,55].

2.3. Circular Economy Principles (CEP)

Unlike the traditional linear economic model, circular economy principles (CEPs) focus on a sustainable and regenerative approach particularly within smart cities [13]. The conventional "take–produce–sell–spend–reject" sequence is now challenged by CEPs, as CEPs promote a closed-loop system to minimize waste. This results in resources being continuously cycled back into the economy [56,57]. The foundational principles of the circular economy are known as the three Rs: Reduction, reuse, and recycling are considered the foundational circular economy principles [20]. Reduction focuses on minimizing resource extraction and consumption. Reuse enhances the life cycle of products, while recycling converts waste into new resources [58,59].

Suárez-Eiroa, Fernández [60] highlighted the operationalization of circular economy principles, which involves distinguishing between renewable and nonrenewable resources. For renewable resources, the extraction rate should not exceed the regeneration rate, aligning with the sustainable development targets [61,62]. According to de Oliveira and Oliveira [63], nonrenewable resources, by contrast, should be used sparingly, with an emphasis on developing renewable alternatives to ensure long-term sustainability. CEPs also advocate for the minimization of waste, distinguishing between biological and technical waste [63]. Biological waste should be reintegrated into natural cycles, while technical waste requires human intervention for reintegration into the economic system [64,65].

Suárez-Eiroa, Fernández [60] asserted that the operational principles of the circular economy include closing the system, maintaining the resource value, and reducing the system's size. These principles include strategies such as enhancing energy efficiency, promoting renewable energy, increasing product durability, and re-circulating resources [66,67]. On the other hand, transversal operational principles, including design and education for CEPs, are essential. Based on these two principles, design plays an important role in ensuring that products are recyclable, repairable, and modular. Korhonen, Nuur [68] noted

that education fosters a societal shift towards a circular economy mindset, involving both producers and consumers.

2.4. Customer-Centric Green Supply Chain Management (CCGSCM)

Customer-centric green supply chain management (GSCM) contributes to the smart business concept by integrating sustainable practices with a focus on customer needs, enhancing resource efficiency, reducing environmental impact, and promoting circular economy principles, as evidenced by recent research [69]. In the current business landscape, smart business practices face a fundamental shift toward focusing on customer satisfaction while integrating environmental sustainability [70]. The primary objective of CCGSCM is not only to increase the efficiency and sustainability of supply chain practices, but also to consider customers' expectations. This aspect is particularly relevant and preferred in today's environmentally conscious market [71].

Previous studies have highlighted that aligning green supply chain management (GSCM) practices with customer expectations can significantly improve operational efficiency while simultaneously enhancing customer satisfaction [72,73]. This dual focus on efficiency and satisfaction positions CCGSCM as a critical strategy for businesses aiming to thrive in the modern marketplace.

This approach aligns supply chain practices with customer expectations for sustainability, especially in the post-COVID-19 era. The pandemic has further amplified the relevance and popularity of CCGSCM, changing consumers' expectations, making them more proactive in seeking sustainable practices and expecting organizations to engage in and incorporate social responsibility and sustainable practices [74]. This shift has developed unique opportunities for businesses to re-evaluate and enhance their strategies regarding GSCM. By emphasizing a customer-centric approach and prioritizing environmental sustainability, businesses can better meet the evolving demands of the market [75].

3. Theoretical Lens and Hypothesis Development

3.1. Stakeholder Theory and Technology Acceptance Model

Stakeholder theory emphasizes considering all stakeholders in decision-making, which is critical in facilitating blockchain adoption through conflict management. The diverse needs of stakeholders, such as employees and customers, must be effectively managed to align their interests with blockchain adoption [76]. This study uses stakeholder theory to explore how conflict management strategies address stakeholder concerns, facilitating blockchain adoption. The Technology Acceptance Model (TAM) highlights usability and perceived usefulness as key factors influencing technology adoption [25].

It is important to understand how different internal stakeholders, including employees and management, interact and resolve conflicts [77]. According to Okoye, Egbunike [78], conflict management strategies help address the various needs and views of different stakeholders, such as employees, managers, customers, suppliers, and regulatory bodies in the organization, especially in Jordan [79]. Concerning smart technology adoption, Gao [80] noted that stakeholder theory highlights the significance of considering the expectations and requirements of both internal stakeholders (like employees who will use the technology) and external stakeholders (such as customers demanding transparency and suppliers involved in the smart technology). Kramer, Bitsch [81] emphasized that SMEs need a dual emphasis to utilize and incorporate smart technologies effectively. This hypothesis is pertinent to the study because blockchain technology frequently necessitates organizational transformation, which has varying impacts on stakeholders. Implementing blockchain technology necessitates identifying and effectively managing various stakeholders' diverse interests and influences. The active participation of stakeholders in the decision-making process can enhance the acceptance and effectiveness of blockchain technology.

The Technology Acceptance Model (TAM) proposed by Davis [25] provides a framework for understanding how the usability and usefulness of technology impact customer adoption, with usability and perceived usefulness being key factors expected to influence

the popularity of blockchain technology. Implementing conflict resolution strategies that address stakeholder concerns and emphasize the advantages of blockchain technology may enhance stakeholders' perceptions of the technology, affecting their willingness to embrace it. Furthermore, regarding circular economy principles, stakeholder theory highlights the need to align business practices with the broader environmental and social goals valued by external stakeholders, including customers, community groups, and regulatory agencies [82]. Finally, in the context of CCGSCM, Chavez, Yu [69] employed this theory and noted that stakeholder theory highlights the role of customers as key stakeholders. Based on customers' demand for environmentally sustainable products, SMEs adopt green practices in their supply chains. Cousins, Lawson [83] noted that this theory helps understand the role of customer preferences in driving supply chain management decisions. In this study, stakeholder theory was employed to explain the relationships and develop hypotheses. The relationships and hypotheses are presented in Figure 1.

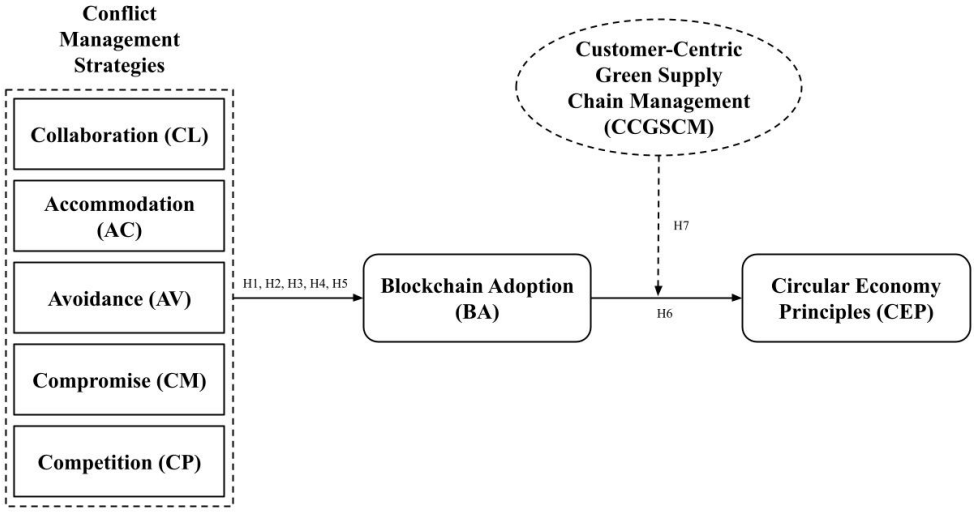


Figure 1. Conceptual model of blockchain adoption and circular economy principles in Jordanian SMEs.

3.2. Conflict Management Strategies and Blockchain Adoption

The adoption of smart technology in Jordanian SMEs is intricately linked to the effective management of stakeholder conflict [16,17]. Muniandi [84] asserted that there may be conflicting opinions, resistance to change, or a lack of understanding among stakeholders regarding the adoption of new technologies such as blockchain; therefore, conflict management strategies play a key role in solving such conflicts [85]. By employing these strategies, organizations can ensure a smooth and inclusive transition toward blockchain technology [11,86,87]. This study aims to explore how specific conflict management strategies impact blockchain adoption, providing a nuanced understanding that goes beyond general positive associations. The following is a brief explanation of the five conflict management strategies.

3.2.1. Collaboration (CL)

Collaboration (CL) is a conflict management strategy that emphasizes cooperation among stakeholders to achieve mutually advantageous outcomes. This approach requires both high assertiveness and cooperativeness [33]. Research by Monteiro and Balogun [34] indicates that emotional intelligence plays a significant role in predicting the utilization of collaboration during conflicts. The importance of this strategy lies in its capacity to generate win–win scenarios. Additionally, Salinas [35] highlights its relevance in stakeholder interactions, where collaborative problem-solving can foster innovative solutions.

As a fundamental conflict management approach, collaboration promotes a culture of open communication and cooperative problem-solving, which enhances the perceived

benefits of blockchain technology for all stakeholders involved. This strategy is crucial for improving engagement and facilitating technology adoption, aligning with the Technology Acceptance Model (TAM) [88]. It is particularly effective in situations that require robust stakeholder engagement and alignment. By creating a supportive atmosphere, collaboration strengthens the acceptance and integration of blockchain technology within organizations [89].

In summary, effective conflict management strategies are essential for facilitating smart technology adoption, particularly blockchain, within organizations. Consequently, we propose the following hypothesis.

H1. *Collaboration, as a conflict management strategy employed by senior managers and department heads, significantly enhances the likelihood of blockchain adoption in Jordanian SMEs by promoting open communication and joint problem-solving.*

3.2.2. Accommodation (AC)

Accommodation (AC) is characterized by the preference for another perspective, often at one's own expense [36]. This strategy is marked by high levels of cooperativeness, but low levels of assertiveness. Research by Gbadamosi, Ghanbari Baghestan [37] identified gender-based differences in the preference for accommodation, noting that females tend to favor this approach more than males. Such a strategy can be effective in preserving relationships, particularly when the issue at hand holds greater significance for the other party.

Diab, Pabbajah [90] emphasized that accommodation is vital for addressing stakeholders' concerns regarding the adoption of new technologies. By ensuring that all voices are heard, accommodation can enhance stakeholders' perceptions of the technology's usefulness, facilitating blockchain adoption [91,92]. This strategy is especially pertinent in hierarchical organizations, where top–down directives can benefit from acceptance and support across multiple levels.

In summary, conflict management strategies play a crucial role in aiding the adoption of smart technologies, particularly blockchain, within organizations. Therefore, we propose the following hypothesis.

H2. *Accommodation, as a conflict management strategy used by decision-makers, facilitates blockchain adoption in Jordanian SMEs by ensuring stakeholder concerns are addressed.*

3.2.3. Avoidance (AV)

Avoidance (AV) involves evading a conflict and failing to address either of the parties' concerns. Vallone, Dell'Aquila [38] indicated that this strategy is characterized by low levels of assertiveness and cooperativeness. Furthermore, Smiley [39] highlighted that internal conflict can heighten the likelihood of opting for avoidance. This strategy is often employed when a conflict is deemed insignificant or when additional information is needed.

In addition, avoidance can appear passive; however, it can be strategically utilized to manage conflicts that are either premature or founded on misinformation. This allows stakeholders the necessary time to assess the technology's usability before adoption [93].

In summary, conflict management strategies are essential for facilitating the adoption of smart technologies, particularly blockchain, within organizations. Consequently, we propose the following hypotheses.

H3. *Avoidance, as a conflict-management strategy utilized by organizational leaders, strategically delays premature conflicts to support the thorough evaluation and eventual adoption of blockchain technology in Jordanian SMEs.*

3.2.4. Compromise (CM)

Compromise (CM) entails finding a middle ground where each party makes concessions, reflecting a moderate level of both assertiveness and cooperativeness [40]. Smiley [39]

noted that individuals are more likely to favor compromise when interpersonal conflict is present, indicating its effectiveness as a balanced approach to conflict resolution.

As a crucial conflict management strategy, compromise plays a vital role in aligning the objectives of blockchain adoption with stakeholder interests [94]. It fosters a balance among competing interests, ensuring that blockchain technology adoption is both practical and consistent with the organization's goals. However, any compromise reached must be realistic and attainable, considering the organization's limitations [95].

In summary, conflict management strategies are instrumental in facilitating the adoption of smart technologies, particularly blockchain, within organizations. Therefore, we propose the following hypotheses.

H4. *Compromise, as a conflict management strategy adopted by key stakeholders, balances diverse interests to promote the realistic and achievable implementation of blockchain in Jordanian SMEs.*

3.2.5. Competition (CP)

Competition (CP) is characterized by an assertive and uncooperative approach aimed at achieving success in a conflict at the expense of the other party [36]. This strategy is often employed when an individual's rights or principles are threatened. However, Khan, Hussainy [41] found that competitive strategies could have detrimental effects on organizational performance if not managed appropriately. This highlights the necessity for careful consideration when applying this approach in interactions with stakeholders.

When utilized effectively within an organization, competition can serve as a catalyst for innovation and progress, encouraging departments to expedite the adoption of blockchain technology due to the perceived competitive benefits it offers. A spirit of competition can drive various departments to engage actively with blockchain technology and pursue efficient, creative solutions [96]. This internal motivation can accelerate the adoption process, resulting in more effective and competitive blockchain applications [84].

In summary, conflict management strategies play a crucial role in facilitating the adoption of smart technologies, particularly blockchain, within organizations. Therefore, we propose the following hypotheses.

H5. *Competition, as a conflict management strategy fostered within departments, drives innovation and significantly enhances blockchain adoption in Jordanian SMEs by leveraging competitive dynamics.*

By focusing on these specific hypotheses, this study aims to contribute a detailed and contextually rich understanding of how different conflict management strategies impact the adoption of blockchain technology in Jordanian SMEs.

3.3. Blockchain Technology Adoption and Circular Economy Principles

Blockchain adoption enhances sustainability in supply chains by providing transparent and immutable records [97]. This relationship is particularly highlighted in Green Supply Chain Management (GSCM), where the capabilities of smart technology align well with sustainability goals and transparency, which are highly valued by external stakeholders [5]. This alignment supports circular economy principles by reducing waste and optimizing resource utilization. Geissdoerfer, Savaget [59] and Narayan and Tidström [98] noted the role of blockchain technology in promoting a decentralized approach to value creation, which is crucial for models of circular economy principles (CEPs) that aim to minimize waste and maximize resource efficiency.

Smart technology can be applied to multiple sectors. For instance, Tan, Wang [99] asserted that blockchain technology is a smart technology that can improve vehicle routing and minimize energy consumption and carbon emissions in the manufacturing sector, and the IoT can collect data for real-time decisions. In the food supply chain, smart technology increases traceability and reduces waste [100]. The use of smart contracts and tokenization in smart technology platforms streamline CEP processes. These features enable automated

and secure transactions and agreements that are essential for efficient resource circulation and waste minimization [98,101]. However, the integration of blockchain technology into existing systems is not without challenges. Trust, reliability, and organizational change are significant barriers that must be addressed for smart technology to realize its full potential in advancing CEPs [59,102].

The objective of CEPs is to reduce or completely eradicate waste, a goal emphasized by Schulte [103]. This reduction can be achieved by converting the end-of-life of products and services into renewed value, thereby extending their lifespans or creating new usage methods [104]. This approach ensures the sustainable circulation of resources. Additionally, integrating the concept of CEPs with systems thinking is recommended, where a business model incorporates a broader network of stakeholders to promote a cyclical life cycle in the design of products and services [98,105]. In this context, Yadav and Singh [53] stated that blockchain technology plays a pivotal role by underpinning these systems and connecting complex networks and databases with configurations that allow for simultaneous, irreversible updates and the potential for necessary automation. The successful implementation of such innovations requires various firms within a network or chain to adapt and integrate this blockchain technology [102]. Blockchain technology adoption, in particular, is increasingly recognized as a key driver in the digital economy [13]. Hence, based on the above discussion, it can be concluded that blockchain adoption is beneficial for CEPs; therefore, the following hypothesis is proposed.

H6. *Blockchain adoption by Jordanian SMEs has a positive impact on the implementation of Circular Economy Principles (CEPs).*

3.4. Moderating Role of Customer-Centric Green Supply Chain Management

Customer-centric green supply chain management (CCGSCM) enhances blockchain effectiveness in promoting circular economy principles by aligning technological efforts with market demands [69]. Blockchain technology, which is known for its ability to ensure transparency, traceability, and efficiency, and plays a significant role in enhancing circular economy principles [1,3]. Upadhyay, Mukhuty [13] noted that smart technology enables product tracking throughout the product's lifecycle; therefore, this technology facilitates the principles of reduction, reuse, and recycling inherent in the circular economy principles model [106]. However, the effectiveness of blockchain technology in promoting circular economy principles can be significantly influenced by how supply chains are managed, particularly from a customer-centric green perspective. Chavez, Yu [69] highlighted the significance of customer-centric GSCM and asserted that it involves understanding and responding to customer demands for sustainable products and practices. Modern consumers are increasingly environmentally conscious and seek products that align with sustainable practices [107]. This shift in consumer behavior drives companies to adopt more sustainable practices [19,70].

Moreover, ref. [108] noted that customer-centric GSCM facilitates a feedback loop between consumers and companies. As consumers use products and provide feedback, companies gain valuable insights into consumer preferences and behaviors [109]. This information can be crucial for refining product design, sourcing strategies, and manufacturing processes in line with circular economy principles [110]. Smart technology can enhance this feedback loop by offering a reliable and transparent method of collecting and analyzing consumer data. Furthermore, the alignment of blockchain adoption with market needs is crucial to ensure that blockchain adoption effectively supports circular economy principles by focusing on areas that are most impactful from a sustainability perspective [111]. Hence, based on the above discussion, customer-centric GSCM increases the strength of the relationship between the blockchain adoption and circular economy principles. Therefore, the following hypothesis was developed.

H7. *Customer-centric green supply chain management (CCGSCM) moderates the relationship between blockchain adoption and Circular Economy Principles (CEPs), strengthening the positive impact of blockchain adoption on CEPs in Jordanian SMEs.*

4. Methodology

This study investigates the complex interplay between conflict management strategies, blockchain adoption, and circular economy principles within Jordanian SMEs. To rigorously examine these relationships, we employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0. PLS-SEM is particularly well-suited for this research for several reasons. First, it excels in predicting outcomes and handling complex models with multiple latent variables, such as organizational readiness and stakeholder engagement [19,112]. This is crucial in our context, as blockchain adoption is influenced by a multitude of interconnected factors, both observable and latent. Second, PLS-SEM allows for the simultaneous examination of direct and indirect effects, enabling us to understand not only how different conflict management strategies directly influence blockchain adoption, but also how they might indirectly impact circular economy practices through their influence on blockchain adoption [113]. Finally, PLS-SEM is robust to data that may not perfectly meet the distributional assumptions of covariance-based SEM, making it appropriate for this study, especially when dealing with real-world data from SMEs [114]. This approach provides a comprehensive and rigorous framework for analyzing the intricate relationships between the variables under investigation.

4.1. Study Context and Sampling

Jordanian SMEs were selected for this study. This context was selected due to the significance of SMEs in the context of Jordan's economy. These businesses are pivotal in driving economic growth, as evidenced by various studies. For instance, SMEs represent approximately 95% of all registered firms in Jordan, contributing significantly to GDP and employment [8]. Their potential for flexibility and innovation makes them ideal candidates for adopting cutting-edge technologies like blockchain. Abu-baker and Adeinat [115] found that credit guarantees in Jordan have a positive impact on the economy and note that SMEs play a major role in the national economy. Their findings revealed that government interventions have successfully overcome the financial constraints of SMEs, thereby boosting economic growth.

Additionally, the research of Al-Hyari [116] on the impact of the COVID-19 pandemic on Jordanian manufacturing SMEs revealed the sector's vulnerability and significance. The study shows that a significant portion of these enterprises experienced a drop in sales due to the pandemic, highlighting their critical role in the economy and the need for strategic decisions focusing on SME recovery.

Finally, Alkousini [117] examined the impact of SME finance on Jordan's economic growth. The findings suggest that small and medium-sized finance positively influences economic growth, highlighting the importance of SMEs in the national economic landscape.

4.1.1. Participants and Recruitment

Similar to Hassan, Khan [1], Chowdhury, Rodriguez-Espindola [49], and Mukherjee, Nagariya [3], this study selected top-level executives, senior managers, and department heads. These individuals are key decision-makers who have a comprehensive understanding of the company's strategic direction and operational practices. This demographic was chosen specifically because their perceptions and attitudes toward blockchain technology are likely to significantly influence the organizational readiness and overall acceptance of such innovations. They were recruited through professional networks, industry associations, and direct invitations explaining the purpose of the study and requesting their participation. Follow-up emails and phone calls were made to ensure a sufficient response rate.

4.1.2. Data Collection

Data were collected using an online survey platform to ensure convenience and accessibility for participants. The survey included questions designed to measure conflict management strategies, blockchain adoption, and circular economy principles (CEPs). The data collection period spanned from July to September 2023. Participants were assured of the confidentiality of their responses and the anonymity of their data to encourage honest and accurate reporting.

4.2. Study Design

The survey was conducted to evaluate blockchain technology adoption within Jordanian SMEs. The participants were surveyed using an online questionnaire distributed over a period of three months. The questionnaire was designed to capture detailed information on conflict management strategies, blockchain adoption, circular economy principles, and customer-centric green supply chain management. The survey ensured anonymity and confidentiality to encourage honest and unbiased responses.

4.3. Meaurement Instruments

The survey included items to measure conflict management strategies, blockchain adoption (BA), circular economy principles (CEPs), and Customer-Centric Green Supply Chain Management (CCGSCM), ensuring that all constructs were adequately operationalized.

4.3.1. Conflict Management Strategies Meaurement Instruments

The study used a previously validated scale to measure the constructs, Rahim's conflict management strategies inventory, due to its specific design for organizational and business settings, making it more relevant for our analysis of conflict management in Jordanian SMEs. A modified version of Rahim's 1983 Conflict Management Styles Inventory was used, incorporating 15 items instead of the original 28. The selection of these 15 items was made to ensure the questionnaire remained concise and manageable for respondents, critical in survey-based research to maintain engagement and response rates. The selection was based on their relevance to organizational settings and their ability to comprehensively capture the essence of the five conflict management strategies: collaboration, accommodation, avoidance, compromise, and competition. The specific items chosen were those that previous studies had found to be most applicable to organizational contexts [29,118].

4.3.2. Blockchain Adoption (BA) Meaurement Instruments

Blockchain adoption (BA) refers to the extent to which blockchain technology is implemented and utilized within an organization's operations. BA was measured using a three-item scale adapted from Mohamed, Haddad [19]. The items focused on employee perceptions of blockchain technology adoption, perceived usefulness, ease of use, and implementation success of blockchain technology within the organization.

4.3.3. Circular Economy Principles Meaurement Instruments (CEPs)

Circular economy principles (CEPs) involve sustainable practices aimed at reducing waste and promoting resource use and recycling. CEPs were measured using a nine-item scale developed by Zeng, Chen [119], in line with Rodríguez-Espíndola, Cuevas-Romo [120].

4.3.4. Customer-Centric Green Supply Chain Management (CCGSCM) Meaurement Instruments

Customer-Centric Green Supply Chain Management (CCGSCM) refers to the integration of environmentally sustainable practices into supply chain management, focusing on meeting customer expectations. CCGSCM was measured using a three-item scale developed by Vachon and Klassen [121], in line with Chavez, Yu [69].

Respondents indicated their level of agreement with statements on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

5. Data Analysis and Results

The data collected from the survey were analyzed using descriptive and inferential statistics to gain a comprehensive understanding of the impact of conflict management strategies on blockchain adoption among Jordanian SMEs. The analysis began with descriptive statistics to provide an overview of the sample characteristics, including the mean, standard deviation, and distribution of responses for each item in the survey.

The collected data were analyzed using SPSS 21 and SmartPLS 3.0. Demographic characteristics were analyzed using frequency distribution with the help of the SPSS 21. Table 1 shows that the final sample consisted of 421 respondents, with the plurality of the respondents being male (66.3%), reflecting the gender division in top positions in Jordanian SMEs. Most respondents were in the age range of 31–40 years (52.5%), while the smallest number of participants were above 50 years of age.

Table 1. Demographic profile of respondents.

Demographic Characteristics		Number	Percentage
Gender	Male	279	66.3
	Female	142	33.7
	Total	421	100.0
Age	<30 years	83	19.7
	31–40 years	221	52.5
	41–50 years	90	21.4
	>50 years	27	6.4
	Total	421	100.0
Qualification	Bachelor's Degree	170	40.4
	Master's Degree	222	52.7
	Doctorate or Higher	29	6.9
	Total	421	100.0
Experience	<1 year	16	3.8
	1–5 years	122	29.0
	5–10 years	81	19.2
	>10 years	202	48.0
	Total	421	100.0
Position	Senior Manager	188	44.7
	Department Head	149	35.4
	Executive	84	20.0
	Total	421	100.0
Department	Production/Operations	184	43.7
	Supply Chain and Logistics	111	26.4
	Research & Development	35	8.3
	Human Resources	7	1.7
	Finance and Accounting	21	5.0
	IT and Technology	49	11.6
	Other	14	3.3
	Total	421	100.0

This table provides detailed demographic information about the study's respondents, including gender, age, qualification, experience, position, and department.

The majority of the respondents (52.7%) hold a master's degree, while most of the respondents (48%) have more than 10 years of working experience. Table 1 highlights that the majority of the respondents were senior managers (44.7%), and most of the participants belonged to the production/operations department (43.7%) in their organizations. The participants held various positions, including senior managers (44.7%), department heads

(35.4%), and executives (20.0%), with a significant portion having more than 10 years of experience (48%).

5.1. Descriptive Statistics

Table 2 presents the descriptive statistics for the variables used in this study, providing summarized information regarding the direction of relationships and normality statistics [122]. The mean values range from 2.877 to 3.066, while the standard deviation (SD) values lie in the range of 0.6785 to 1.0059. These values indicate a consistent direction of relationships among the variables and suggest a normal distribution of responses. The mean values reflect the positive relationships among variables, while the standard deviation values indicate a typical variation around the mean. All values fall within the acceptable range, confirming a normal variation among responses. For example, collaboration was measured using questions such as, "I try to integrate my ideas with those of my partner to come up with a decision jointly." These values reflect consistent relationships among variables and normal variation within the data.

Table 2. Descriptive statistics.

Variable Names	Mean	SD	Skewness		Kurtosis	
			Stat	Error	Stat	Error
Collaboration	2.984	0.9168	−0.096	0.119	−0.917	0.237
Compromise	2.877	0.9631	0.044	0.119	−0.865	0.237
Accommodation	2.995	0.9817	−0.016	0.119	−0.839	0.237
Avoidance	3.052	0.9655	−0.088	0.119	−0.898	0.237
Competition	2.911	1.0059	0.021	0.119	−0.918	0.237
Blockchain Adoption	2.940	0.6785	−0.116	0.119	0.460	0.237
Circular Economy Principles	3.007	0.8312	−0.031	0.119	−1.123	0.237
Customer-Centric GSCM	3.066	0.8892	−0.120	0.119	−0.780	0.237

This table presents the descriptive statistics for the conflict management strategies, blockchain adoption, and circular economy principles, providing the descriptive statistics and summarized information regarding the direction of relationships and normality statistics. It shows that skewness values fall in the range of +3 to −3, and kurtosis values fall in the range of +10 to −10; therefore, the normality of the data is acceptable [123].

5.2. Reliability and Validity

Table 3 shows the results regarding the factor loadings, reliability, validity measures, and multicollinearity. These results were obtained by conducting exploratory and confirmatory factor analysis to ensure the robustness of the measurement model. This table shows that all factor loadings are above 0.5, indicating acceptable convergent validity, and there is no need to remove any item [124]. Reliability was measured using both popular methods, Cronbach's alpha (α) and Composite Reliability (CR). Although α is considered a less accurate measure (as it assumes that all indicators are equally weighted and contribute equally to the construct) than CR (as it takes into account the different loadings of indicators on a latent variable), it is still prevalent among the majority of scholars; therefore, both measures are utilized in this study [125].

According to most scholars, the acceptable range of both α and CR is 0.6 to 0.7 or above [126,127]. However, situations may arise wherein α falls below 0.6, whereas CR exceeds 0.7. In such scenarios, it is important to note that an α value lower than 0.6 suggests reduced reliability of the latent constructs per the standards set by Nunnally and Bernstein [128]. Conversely, if the CR value for all latent constructs is above 0.70, it can serve as a substitute measure for construct reliability, particularly in cases wherein the α value is marginally lower than the CR value, as indicated by Peterson and Kim (2013). A CR value exceeding 0.7 is indicative of satisfactory reliability of the latent variables, as noted by Bell, Bryman [129]. Therefore, based on these standards, although the value of α is below 0.6, the values of CR for all variables are above 0.6, demonstrating an acceptable reliability level.

Table 3. Reliability and validity.

Construct	Loadings	VIF	α	CR	AVE
Collaboration			0.726	0.843	0.641
CMS_C1	0.843	1.376			
CMS_C2	0.760	1.439			
CMS_C3	0.798	1.485			
Compromise			0.773	0.866	0.683
CMS_CO1	0.871	1.554			
CMS_CO2	0.803	1.573			
CMS_CO3	0.803	1.637			
Accommodation			0.780	0.865	0.682
CMS_AC1	0.893	1.631			
CMS_AC2	0.757	1.654			
CMS_AC3	0.822	1.572			
Avoidance			0.778	0.864	0.681
CMS_AV1	0.892	1.557			
CMS_AV2	0.780	1.568			
CMS_AV3	0.799	1.779			
Competition			0.796	0.880	0.710
CMS_COM1	0.855	1.775			
CMS_COM2	0.840	1.604			
CMS_COM3	0.833	1.722			
Blockchain Adoption			0.534	0.762	0.517
BA1	0.723	1.153			
BA2	0.674	1.114			
BA3	0.758	1.148			
Circular Economy Principles			0.895	0.914	0.541
CEP1	0.784	1.775			
CEP2	0.756	1.794			
CEP3	0.710	1.725			
CEP4	0.719	1.692			
CEP5	0.751	1.944			
CEP6	0.702	1.683			
CEP7	0.750	1.859			
CEP8	0.731	1.836			
CEP9	0.714	1.753			
Customer-Centric GSCM			0.717	0.839	0.635
CCGSCM1	0.828	1.349			
CCGSCM2	0.797	1.459			
CCGSCM3	0.765	1.425			

This table shows the factor loadings, variance inflation factors (VIF), Cronbach's alpha (α), Composite Reliability (CR), and Average Variance Extracted (AVE) for each construct, providing evidence for the measurement model's robustness. Each construct is measured by several items; for example, the five conflict management strategies (CMS) used in the study (CMS_C1, CMS_C2, CMS_CO1, CMS_AC1, etc.). The numbering indicates the specific survey items used to measure each strategy. Each construct name reflects the theoretical concept it represents, and the corresponding items were derived from established scales in the literature.

In Table 3, the AVE values show the average variance extracted, commonly used to measure convergent validity [130]. According to Table 3, all AVE values are greater than 0.5; therefore, these values present an acceptable level of convergent validity [131]. To measure discriminant validity, the commonly used criterion proposed by Fornell and Larcker [132] was employed (see Table 4). This method posits that the square root of the AVE must be higher than the corresponding correlation among the variables. The highlighted diagonal values in Table 4 are the square roots of AVE, which are compared to their corresponding values of correlation among variables in rows and columns. Per

the criterion, the square root values of AVE are greater than the correlation values of the variables; therefore, discriminant validity is acceptable.

Table 4. Discriminant validity.

	1	2	3	4	5	6	7	8
Accommodation	**0.826**							
Avoidance	−0.053	**0.825**						
Blockchain Adoption	0.148	0.126	**0.719**					
Circular Economy Principles	0.004	−0.112	0.160	**0.736**				
Collaboration	0.037	0.024	0.201	0.003	**0.801**			
Competition	0.009	−0.042	0.134	−0.061	0.040	**0.842**		
Compromise	−0.071	0.057	0.188	−0.108	0.043	0.038	**0.826**	
Customer-Centric GSCM	−0.074	0.038	0.048	0.093	−0.039	0.053	−0.039	**0.797**

This table presents the discriminant validity of the constructs. The diagonal elements (in bold) represent the square root of the Average Variance Extracted (AVE) for each construct, indicating the amount of variance captured by the construct relative to the amount of variance due to measurement error. The off-diagonal elements represent the correlations between the constructs. The correlations are provided to demonstrate that each construct shares more variance with its own indicators than with other constructs, thereby supporting discriminant validity.

5.3. Hypothesis Testing

A robust Structural Equation Modeling (SEM) approach was employed to test the hypotheses and analyze the complex relationships involved, which is a rigorous and novel approach in this context. SEM is particularly well-suited for this study due to its capacity to simultaneously examine multiple relationships between latent constructs, as highlighted by Kline [133]. This provides a comprehensive understanding of how conflict management strategies influence blockchain adoption. The structural model, developed using Bootstrapping in SmartPLS, is presented in Figure 2.

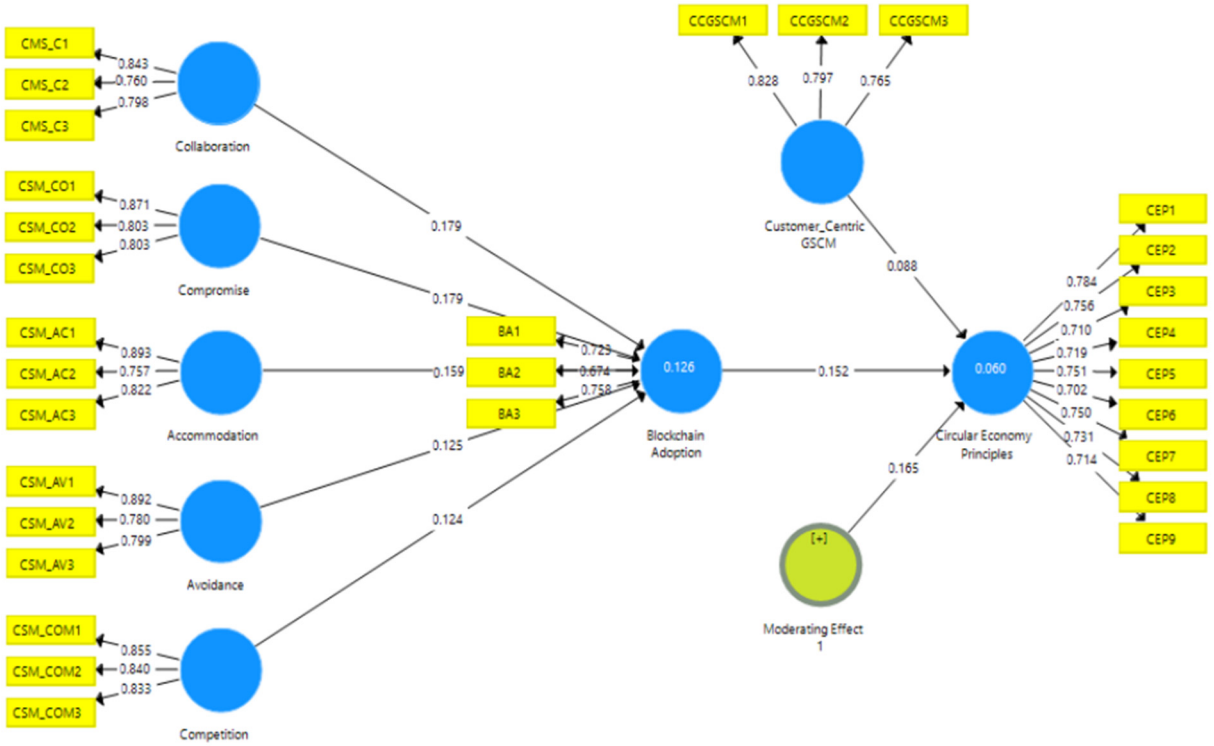


Figure 2. Structural model. This figure illustrates the relationships between conflict management strategies, blockchain adoption, and circular economy principles, highlighting the significant path coefficients and their corresponding t-values and *p*-values.

Path diagrams visually depict the hypothesized relationships. Prior research, such as Davis [25,134], has utilized SEM to investigate technology adoption within organizations, establishing its suitability for testing similar hypotheses. This study builds upon this empirical foundation to delve into the influence of conflict management strategies on blockchain adoption and subsequent circular economy principles in Jordanian SMEs.

Table 5 details the path coefficients, revealing that collaboration and compromise are the most influential conflict management strategies in fostering blockchain adoption within Jordanian SMEs. These findings lend support to hypotheses 1 and 4. While accommodation, avoidance, and competition also exhibit positive impacts on blockchain adoption, their effects are comparatively weaker. Furthermore, blockchain adoption positively influences circular economy principles, thereby supporting hypothesis 6. The moderating effect of customer-centric green supply chain management (CCGSCM) on the relationship between blockchain adoption and circular economy principles is also positive and significant, confirming hypothesis 7.

Table 5. Path coefficients.

		Original Sample	Sample Mean	SD	t	*p*
H1	Collaboration → Blockchain Adoption	0.179	0.187	0.046	3.885	0.000
H2	Accommodation → Blockchain Adoption	0.159	0.165	0.043	3.679	0.000
H3	Avoidance → Blockchain Adoption	0.125	0.134	0.039	3.233	0.001
H4	Compromise → Blockchain Adoption	0.179	0.183	0.045	3.959	0.000
H5	Competition → Blockchain Adoption	0.124	0.126	0.050	2.460	0.014
H6	Blockchain Adoption → Circular Economy Principles	0.152	0.149	0.049	3.067	0.002
H7	Moderating Effect 1 → Circular Economy Principles	0.165	0.192	0.076	2.166	0.031

This table summarizes the path coefficients for the hypothesized relationships, including the original sample, sample mean, standard deviation, t-value, and *p*-value.

The path coefficients results, as detailed in Table 5, reveal the magnitude and significance of the relationships between conflict management strategies, blockchain adoption, and circular economy principles. Below is an interpretation of path coefficients.

- ***H1 (Collaboration → Blockchain Adoption):*** The path coefficient (β = 0.179, $p < 0.01$) indicates a significant positive relationship, suggesting that increased collaboration among stakeholders enhances the likelihood of blockchain adoption.
- ***H2 (Accommodation → Blockchain Adoption):*** The path coefficient (β = 0.159, $p < 0.01$) indicates a significant positive relationship, demonstrating that adopting an accommodating approach in conflicts can contribute to the successful adoption of blockchain technology.
- ***H3 (Avoidance → Blockchain Adoption):*** The path coefficient (β = 0.125, $p < 0.01$) indicates a positive and significant relationship, though smaller compared to collaboration and compromise, suggesting that avoiding conflicts, while somewhat helpful, might not be as effective as other strategies in facilitating blockchain adoption.
- ***H4 (Compromise → Blockchain Adoption):*** Similar to collaboration, compromise exhibits a significant positive impact on blockchain adoption (β = 0.179, $p < 0.01$), indicating that finding middle-ground solutions in conflicts can be instrumental in driving blockchain adoption.
- ***H5 (Competition → Blockchain Adoption):*** The smallest path coefficient among the five conflict management strategies (β = 0.124, $p < 0.05$) suggests that competition might be the least effective approach in fostering blockchain adoption, although the relationship remains positive and significant.
- ***H6 (Blockchain Adoption → Circular Economy Principles):*** The path coefficient (β = 0.152, $p < 0.01$) demonstrates a significant positive relationship, implying that

the adoption of blockchain technology can contribute to the implementation of more sustainable business practices.

- ***H7 (Moderating effect (CCGSCM) → Circular Economy Principles):*** The path coefficient ($\beta = 0.165$, $p < 0.05$) indicates a positive and significant relationship, suggesting that customer-centric green supply chain management (CCGSCM) strengthens the positive relationship between blockchain adoption and circular economy principles.

The analysis of path coefficients indicates that although all conflict management strategies demonstrate statistically significant positive relationships with blockchain adoption, their strengths vary. Collaboration and compromise exhibit stronger associations compared to accommodation, avoidance, and competition, suggesting a differential impact on blockchain adoption.

While the statistical significance confirms the presence of measurable effects, the relatively small path coefficients imply that the practical implications of these strategies might be modest. It is crucial for practitioners to acknowledge that while these strategies can facilitate blockchain adoption, their effectiveness may differ, and relying solely on them might not be sufficient to drive substantial adoption.

Overall, the results substantiate all hypotheses, indicating that conflict management strategies positively influence blockchain adoption among senior managers, department heads, and executives in Jordanian SMEs. Additionally, blockchain adoption positively affects circular economy principles, and this relationship is moderated by CCGSCM. Notably, collaboration and compromise emerge as the most effective conflict management strategies in this context.

6. Discussion and Conclusions

6.1. Discussion

This study employs a robust methodological approach using structural equation modeling (SEM) to analyze data from 421 senior managers, offering a comprehensive understanding of the impact of conflict management strategies on blockchain adoption. The use of (SEM) in this study represents an innovative approach to analyzing complex relationships. SEM allows for the simultaneous testing of multiple relationships and hypotheses, providing a detailed and rigorous analysis of the impact of conflict management strategies on blockchain adoption. The extensive data collection from 421 senior managers, department heads, and executives adds robustness to the findings. These individuals were chosen for their comprehensive understanding of their organizations' strategic direction and operational practices, ensuring that the data accurately reflects the impact of conflict management strategies on blockchain adoption.

6.1.1. Impact of Conflict Management Strategies on Blockchain Adoption

While the findings confirm the importance of conflict management strategies in the successful adoption of blockchain technology, it is important to note that not all strategies contribute equally. Our analysis using PLS-SEM reveal that collaboration and compromise are the most effective conflict management strategies for promoting blockchain adoption, aligning with Stakeholder Theory and the Technology Acceptance Model (TAM); involving key stakeholders in the decision-making process increases their support for organizational changes (e.g., Freeman [24], Rahim [134]). Similarly, TAM suggests that the perceived usefulness and ease of use of a technology, effectively communicated through collaborative efforts, are critical factors in technology adoption [25]. Moreover, existing research in technology adoption and organizational change suggests that collaborative and compromise-oriented conflict management strategies are likely to be most effective in promoting blockchain adoption within organizations (e.g., Vachon and Klassen [121], Liang, Zhao [135], Mathews [136]).

On the other hand, strategies such as avoidance and competition showed comparatively weaker effects, suggesting that while conflict management is crucial, not all strategies contribute equally to blockchain adoption. This suggests that practitioners should prioritize

strategies that encourage open communication and mutual agreement when implementing new technologies. The modest path coefficients for these strategies highlight the need for a multifaceted approach to technology adoption, integrating conflict management with broader organizational change strategies to achieve more meaningful results.

The study also presents a nuanced view of the impacts of other strategies. Avoidance strategy exhibited a significant, albeit weaker, impact, suggesting that while evading conflict might delay necessary organizational readiness and adaptation to new technologies, it can still play a role in flexibility and consensus among stakeholders and competition; this encourages stakeholders to enhance their competitive edge through innovation and has significant positive impacts on adoption [137,138].

To understand these dynamics more deeply, the following sections provide a detailed analysis of each conflict management strategy's specific impact on blockchain adoption in Jordanian SMEs.

(1) Collaboration

Collaboration stands out as a crucial conflict management strategy for blockchain adoption in Jordanian SMEs. Notably, this approach is highly effective in scenarios wherein high stakeholder engagement and alignment are needed. This is consistent with the literature on this approach, which emphasizes cooperative and integrative strategies, reduces resistance, fosters innovation, enhances operational transparency and agility, and highlights the importance of cooperative and integrative strategies in technology adoption by engaging key stakeholders in decision-making processes, making it well-suited to the challenges of implementing blockchain technology [24,25,29,135,139,140]. In the context of Jordanian SMEs, collaborative environments were found to be conducive to adopting new technologies like blockchain [141,142]. The findings confirm that collaboration not only positively influences perceptions, but also supports the practical integration of blockchain into business processes.

(2) Accommodation

Accommodation was also found to positively influence blockchain adoption. This strategy aligns with Stakeholder Theory, suggesting that accommodating stakeholders' needs creates a conducive environment for technological integration, particularly in sensitive organizational climates wherein the introduction of disruptive technologies like blockchain may be met with skepticism or resistance [24,143]. The flexible nature of accommodation helps resolve conflicts by considering diverse perspectives, facilitating smoother technology adoption [144]. This approach is especially effective in SMEs, where decision-making often involves balancing various stakeholder interests [145].

(3) Avoidance

The study found that avoidance strategies had a non-significant impact on blockchain adoption, suggesting that this cautious approach, which involves deferring decisions until more information is available, may delay organizational readiness for new technologies [93,139,146,147]. This finding challenges the conventional understanding within the Technology Acceptance Model (TAM) and Stakeholder Theory, indicating that avoiding conflict might hinder the timely adoption of blockchain technology. While this strategy ensures well-considered decisions, it may not be effective for quick technology integration [148].

(4) Compromise

Compromise, involving mutually beneficial solutions through concessions, emerged as a viable strategy for facilitating blockchain adoption. This approach balances stakeholder interests and promotes flexibility in decision-making [137,139,149]. The positive effect of compromise on blockchain adoption underscores the importance of consensus in the adoption process, making it effective in addressing diverse stakeholder views and needs [136,150]. This strategy aligns with the role of conflict management in balancing stakeholder interests and fostering the adoption of technology [139,149].

(5) Competition

Competition, when managed positively, can drive stakeholders to embrace blockchain technology to gain a competitive advantage [138]. This strategy promotes creativity and progress by fostering a culture of excellence and innovation within the organization [4,38,151]. Competition pressures were found to have a positive effect on blockchain adoption, particularly in SMEs, where striving for a competitive edge can enhance performance and innovation [152]. This competition environment supports the adoption of blockchain technology to improve organizational performance and maintain a competitive advantage [138,152].

6.1.2. Blockchain Adoption and Circular Economy Principles

The study demonstrates that blockchain adoption significantly influences circular economy principles, supporting the hypothesis that blockchain's features of transparency, traceability, and security align with sustainability goals. This alignment facilitates practices aimed at reducing waste and optimizing resource use [13,98]. The moderating role of customer-centric green supply chain management (CCGSCM) further enhances the relationship between blockchain adoption and circular economy principles, indicating that aligning technological efforts with market demands and customer expectations amplifies the benefits of sustainable practices [69].

Furthermore, the study demonstrates that blockchain adoption significantly influences circular economy principles in Jordanian SMEs, supporting the hypothesis that blockchain's features of transparency, traceability, and security align with sustainability goals. This alignment facilitates practices aimed at reducing waste and optimizing resource use [13,98]. Corsini, Gusmerotti [20] noted that the adoption of blockchain helps track materials and promote different sustainable practices. This finding is consistent with Kshetri [153], who noted that blockchain can increase the supply chain's sustainability and efficiency. Similarly, Hassan, Khan [1], Mukherjee, Nagariya [3] found a positive connection between blockchain adoption and sustainable practices, which are part of the circular economy principles.

6.1.3. The Moderating Role of CCGSCM

The moderating role of Customer-Centric Green Supply Chain Management (CCGSCM) is crucial in aligning technological efforts with customer-centric strategies, ensuring that sustainable initiatives meet market demands and customer expectations [67,109]. This study demonstrates that CCGSCM significantly moderates the relationship between blockchain adoption and circular economy principles. This finding aligns with previous research (e.g., Kholaif, Ming [109] and Centobelli, Cerchione [110]), which shows that customer-focused approaches enhance the connection between sustainable practices and technology.

Moreover, the study deepens our understanding of the interplay between conflict management strategies and smart technology adoption in Jordanian SMEs. Specifically, it highlights how blockchain technology supports circular economy principles when moderated by CCGSCM. According to the literature, blockchain acts as a catalyst for enhancing transparency, traceability, and accountability—key attributes that are essential for implementing circular economy principles [9,151]. Blockchain technology allows for the precise tracking of product lifecycles and resource flows, vital for reducing waste and optimizing resource utilization [57,60].

The moderating effect of CCGSCM ensures that sustainability efforts align with market demands, but also enhance customer satisfaction and business competitiveness. This alignment is critical for the broader adoption and effectiveness of circular economy principles within the SME sector. Additionally, the findings are consistent with previous studies that emphasize the importance of conflict management strategies in adopting new technologies and how blockchain adoption improves sustainable practices. These results also tie into stakeholder theory, contributing to a better understanding of how conflict management influences new technologies adoption in SMEs.

6.2. Implications

6.2.1. Implications Theoretical Implications

This study makes several key theoretical contributions to technology adoption and conflict management. Firstly, it provides a nuanced understanding of how specific conflict management strategies differentially influence blockchain adoption in Jordanian SMEs. While previous research has explored the general relationship between conflict and innovation, this study goes further by examining the unique effects of collaboration, accommodation, avoidance, compromise, and competition on blockchain adoption decisions. This granular analysis contributes to a more refined understanding of how conflict can be strategically managed to facilitate technological innovation within organizations.

Secondly, the study highlights the moderating role of customer-centric green supply chain management (CCGSCM) in the relationship between blockchain adoption and implementation of circular economy principles. This finding extends existing literature by demonstrating how customer-centric approaches to sustainability can amplify the positive effects of blockchain technology on environmental performance. This contribution is particularly significant given the increasing emphasis on sustainable development and the growing demand for environmentally responsible business practices [111,154].

6.2.2. Practical Implications

This study offers practical guidance for managers in SMEs seeking to leverage blockchain technology for sustainable development and competitive advantage. Specifically, it highlights the importance of fostering a collaborative and communicative organizational environment to facilitate the successful adoption of blockchain. This insight provides managers with actionable strategies for navigating the challenges of technology integration and maximizing the benefits of blockchain technology for enhancing supply chain management, data security, and operational efficiency.

Furthermore, the study emphasizes the strategic importance of aligning blockchain adoption with customer-centric green supply chain practices. These findings encourage managers to consider customer expectations for sustainability when implementing blockchain technology, thereby enhancing both environmental and economic performance.

6.2.3. Societal Implications

This research underscores the potential of blockchain technology to contribute to broader societal goals. By demonstrating the positive impact of blockchain adoption on the implementation of circular economy principles, this study highlights the role of SMEs in promoting environmental sustainability and resource efficiency. This contribution is particularly relevant in developing countries like Jordan, where SMEs play a crucial role in driving socioeconomic development and supporting inclusive economic growth.

6.2.4. Implications for Public Policy

This study's findings offer valuable insights for policymakers seeking to promote technology adoption and sustainable development. Specifically, the results suggest that policymakers should consider developing targeted training programs and incentives to encourage blockchain adoption among SMEs. Additionally, supporting conflict management training for managers can further enhance technology integration initiatives' effectiveness.

6.2.5. Implications for Teaching

This research can be integrated into business education curricula to enhance students' understanding of the complex interplay between technology adoption, conflict management, and sustainable development. The study's findings can be used to develop case studies that illustrate the practical challenges and opportunities associated with blockchain adoption in SMEs. Additionally, the study's theoretical framework can serve as a foundation for academic discussions and future research on the strategic role of conflict management in promoting technological innovation and sustainability.

6.3. Limitations and Future Indications

This study offers valuable insights, but has limitations. It focuses on Jordanian manufacturing SMEs, potentially limiting generalizability. Future research should explore diverse contexts. The cross-sectional design captures a single point in time, hindering the observation of evolving dynamics. Longitudinal studies could address this. Self-reported data may introduce bias, and the quantitative approach might miss qualitative nuances. Incorporating mixed methods could provide a richer understanding. While five conflict management strategies were examined, exploring additional strategies could enhance comprehension.

Future research could consider the following.

- Investigate the impact of specific blockchain applications: Explore how different applications of blockchain technology, such as supply chain traceability, smart contracts, and data security, are differentially affected by various conflict management strategies.
- Examine the role of external factors: Consider how external factors, such as government regulations, industry competition, and technological infrastructure, interact with conflict management strategies to influence blockchain adoption decisions.
- Explore the long-term effects: Investigate the long-term effects of different conflict management strategies on the sustainability of blockchain technology adoption and the achievement of circular economy principles.
- Analyze the cost–benefit dynamics: Assess the costs and benefits associated with different conflict management strategies in the context of blockchain adoption, providing practical guidance for SMEs on resource allocation and decision-making.
- Develop a framework for conflict management: Based on the research findings, develop a practical framework or toolkit for SMEs to effectively manage conflicts during the adoption and implementation of blockchain technology.

6.4. Conclusions

This study enhances the understanding of blockchain adoption in small and medium-sized enterprises (SMEs) by emphasizing the importance of conflict management strategies and the moderating effect of Customer-Centric Green Supply Chain Management (CCGSCM). Our findings indicate that collaboration and compromise are the most effective strategies, aligning with prior research that highlights the value of an inclusive work culture that fosters stakeholder involvement in decision-making, thereby promoting technological innovation and reducing resistance.

The analysis reveals that not all conflict management strategies are equally effective; while collaboration and compromise have a strong positive influence, avoidance, accommodation, and competition are less effective. This underscores the need for SMEs to tailor their conflict management approaches to their specific contexts.

By understanding the relationship between conflict management strategies and CCGSCM, SMEs can make informed decisions regarding technology adoption and sustainability initiatives, enhancing their competitiveness and alignment with circular economy principles. These insights empower managers to leverage effective strategies that facilitate blockchain adoption and contribute to a more sustainable future.

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