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Optimizing Working Capital in E-Commerce Supply Chains:
A Data-Driven Financial Approach

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ABSTRACT

This research aims to develop a comprehensive, data-driven financial model for optimizing working capital to enhance operational efficiency and competitiveness in the supply chains of e-commerce companies. Questionnaire data from 280 stakeholders operating within the e-commerce supply chains across the globe were analyzed using structural equation modeling (SEM) analysis to explore the complex interrelations between the variables that optimize working capital in e-commerce supply chains. The findings from SEM analysis reveal that technology integration, such as sensors and AI-driven inventory management systems; market responsiveness through adaptive pricing strategies; and supplier relationship management via ethical and transparent transactions, have a direct positive influence on working capital efficiency in e-commerce supply chains. Furthermore, collaborative planning, via the use of emerging technologies and efficient practices, emerged as the key mediator, amplifying the positive influence of technology integration and supplier relationship management.

KEYWORDS

Working Capital, E-commerce, Supply Chain, Operational Management

INTRODUCTION

The increasing growth of e-commerce, complemented by technological advancements, has transformed the traditional supply chain into a complex e-commerce supply chain. According to Lin and Januardi (2023), the e-commerce supply chain involves a series of logistics processes, which include procuring raw materials, product manufacturing, inventory management, and delivery. Due to high online demand and the need for efficient delivery, companies are improving their supply chain approaches, ranging from same-day and next-day delivery to more accurate inventory management, leveraging emerging technologies like artificial intelligence (AI) to optimize working capital (Gansterer et al., 2018; Vazquez-Noguerol et al., 2022). Working capital is a financial metric that shows the difference between current assets and liabilities (Hu et al., 2024). Thus, effective working capital management is essential for maintaining liquidity and seizing growth opportunities in e-commerce supply chains, ensuring relevance in an increasingly competitive and fast-paced market (Song et al.,

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2024). However, as advancements in e-commerce streamline processes and enable real-time data management, managing working capital has become increasingly complex (Kiymaz et al., 2024).

For instance, rapid technological advancements in digital transactions and automation increase inventory volatility, often leading to excess stock or stockouts that tie up capital and complicate financial planning (Vazquez-Noguerol et al., 2022). Furthermore, extended receivables from diverse payment options and longer credit terms strain cash flow, reducing liquidity (Hu et al., 2024). Additionally, global sourcing creates complex supplier relationships, often resulting in delays and higher administrative costs (Kiymaz et al., 2024). Moreover, the dynamic nature of e-commerce transactions complicates cash flow forecasting, contributing to financial instability. This is further compounded by evolving market conditions, geographical uncertainties, and unexpected pandemics like COVID-19. These inherent challenges ultimately compromise the e-commerce companies' working capital management and hinder their ability to finance growth opportunities and adapt to market changes (Banerjee & Deb, 2023; Kumar & Olasiuk, 2024). As a result, e-commerce companies face financial losses and an increased risk of closures (Dimitropoulos, 2024; Edunjobi, 2024; Nasereddin, 2024), underscoring the critical need to optimize working capital within their supply chains. Kiymaz et al. (2024) posited that optimized working capital enhances the overall performance, sustainability, and resilience of e-commerce companies.

As a result, several studies have been conducted to tackle the unique challenges across various aspects of the e-commerce supply chains to enhance working capital management. For example, Banerjee and Deb (2023), Mohite (2017), and Song et al. (2024) examined how inventory management drives working capital across e-commerce supply chains. Dash et al. (2019), Jauhar et al. (2024), and Kumar et al. (2024a or b) focused on using advanced technologies like AI to enhance working capital in the e-commerce supply chain. Kędzia (2024) and Lahkani et al. (2020) focused on e-commerce supplier relationships. However, these studies focus on isolated aspects without considering the interconnections of components that drive working capital in the e-commerce supply chain. This fragmentation hinders a comprehensive understanding of how components cohesively interact to optimize working capital in e-commerce supply chains. Hence, Ramadan and Morshed (2023), Qi et al. (2023), and Zennaro et al. (2022) developed models that integrate various strategic aspects, including logistics and technology, to effectively manage working capital in e-commerce supply chains. While these studies provide a foundation for enhancing working capital literature, the proposed models are static and do not address the complexities and rapid fluctuations inherent in e-commerce supply chains (Dimitropoulos, 2024; Nasereddin, 2024). To the best of the authors' knowledge, there is a lack of a dynamic, data-driven approach that adapts to the fast-paced and interconnected nature of e-commerce supply chains to optimize working capital, warranting further investigation in this domain.

The aim of this study is to develop a comprehensive, data-driven model that integrates critical components of e-commerce supply chains to optimize working capital. The developed model stands out by uniquely emphasizing the interplay between the identified critical components, creating a holistic framework that adapts to the real-time market dynamics of e-commerce supply chains, thereby optimizing working capital. This study contributes to e-commerce supply chain research by integrating data-driven approaches to optimize working capital management, addressing demand volatility and supply chain complexity, and advancing theories on supply chain finance, cash flow optimization, and inventory management. This study provides e-commerce stakeholders with valuable insights to optimize working capital management through data-driven strategies, offering a practical guide to enhance financial efficiency and supply chain resilience.

LITERATURE REVIEW

E-Commerce Supply Chain: State of the Art

The e-commerce supply chain encompasses a complex system of activities and resources in manufacturing and delivering products to customers' doorsteps. It involves different stakeholders,