

AI-DRIVEN DIGITAL MARKETING AND SUPPLY CHAIN OPTIMIZATION IN TEXTILE E-COMMERCE

M.Sathis Kumar, Sunil Kumar Vohra

Lincoln University College, Petaling Jaya, Selangor Darul Ehsan – 47301, Malaysia.

Email ID : sathismani13@gmail.com, unilvohra2002@yahoo.co.in,

ORCID:0000-0001-6144-0307

Abstract:

The rapid expansion of textile e-commerce has transformed consumer purchasing behavior while creating new challenges in customer engagement, demand forecasting, inventory management, and supply chain coordination. Conventional digital marketing strategies often fail to provide personalized customer experiences and efficient operational decision-making due to limited integration between marketing intelligence and supply chain processes. This study proposes an integrated Artificial Intelligence (AI)-driven framework that combines customer behavior analytics, AI-enabled personalization, predictive demand forecasting, and supply chain optimization to improve business performance in textile e-commerce. Primary data were collected from textile e-commerce consumers, digital marketing professionals, and industry stakeholders using structured questionnaires, while secondary information was obtained from transaction records, platform analytics, and historical sales databases. The collected data were analyzed using descriptive statistics, regression analysis, and hypothesis testing to evaluate the relationships among trust, perceived value, interaction intensity, customer satisfaction, AI personalization, forecasting capability, and supply chain responsiveness. The findings demonstrate that perceived value, customer satisfaction, AI personalization, and AI forecasting significantly enhance purchase intention, customer loyalty, operational efficiency, and sustainability performance, whereas perceived risk negatively influences consumer purchasing behavior. The proposed framework provides practical insights for integrating AI-driven marketing intelligence with supply chain operations to improve customer experience, resource utilization, organizational agility, and long-term competitiveness in textile e-commerce.

Keywords— Artificial Intelligence, Digital Marketing, Textile E-Commerce, Customer Behavior, Supply Chain Optimization, Demand Forecasting, AI Personalization, Sustainability.

1. Introduction

The textile e-commerce industry is growing rapidly due to digital transformation and changing consumer preferences, driving the adoption of AI and ML technologies. AI-powered personalization, predictive analytics, and customer segmentation improve customer engagement and marketing effectiveness. However, challenges in inventory management, demand forecasting, logistics, and supply chain coordination remain. This study proposes an integrated AI-driven framework combining digital marketing, consumer behavior analytics, and supply chain optimization. The framework enhances purchase intention, operational efficiency, supply chain responsiveness, sustainability, and long-term business competitiveness.

Research Objectives

The primary objective of this research is to develop an integrated Artificial Intelligence (AI)-driven framework that combines digital marketing intelligence with supply chain optimization for textile e-commerce applications. Specifically, the study aims to (i) investigate the influence of customer-centric factors such as trust, perceived value, customer satisfaction, emotional engagement, and interaction intensity on purchase intention, (ii) evaluate the contribution of AI-based personalization and predictive demand forecasting toward improving customer experience and operational efficiency, (iii) analyze the relationship between AI-enabled marketing strategies and supply chain responsiveness, inventory

optimization, and sustainability, and (iv) validate the effectiveness of the proposed framework using statistical analysis based on real-world consumer and stakeholder responses.

Significance and Benefits of the Study

The proposed framework provides significant practical and academic contributions by integrating marketing intelligence and supply chain decision-making into a unified AI-driven ecosystem. The framework enables textile e-commerce organizations to improve customer engagement, optimize inventory management, enhance logistics efficiency, reduce operational costs, and support sustainable business practices. The findings also provide valuable insights for researchers, digital marketers, supply chain managers, and policymakers in designing intelligent and data-driven e-commerce systems.

Key Areas of Investigation

This research focuses on five key areas: AI-based customer personalization, consumer behavior analytics, predictive demand forecasting, intelligent supply chain optimization, and sustainable textile e-commerce management, with the objective of improving customer engagement, operational efficiency, and long-term business sustainability.

2. Related Work

Previous studies have extensively examined the roles of digital marketing, artificial intelligence, supply chain optimization, and consumer behavior analytics in e-commerce. The findings indicate that omnichannel commerce, AI-driven technologies, and digital customer engagement improve customer experience, strengthen personalized services, and enhance overall business performance and competitiveness [1]. In order to improve operational efficiency and competitive advantage, big data analytics and machine learning approaches have also been used to improve inventory management, demand forecasting, and organizational decision-making [2]. Additionally, by offering individualized purchasing experiences across many digital platforms, customer journey analysis and personalized recommendation systems have shown favorable benefits on consumer happiness, trust, and purchase intention [3]. In order to improve supply chain resilience, operational responsiveness, and sustainability performance, recent studies have also emphasized the significance of digital twin technologies, predictive logistics, and AI-enabled supply chain management [4].

Table 1. Comparison with Existing Research

Research Work	AI Personalization	Consumer Behavior Analysis	Supply Chain Optimization	Sustainability
[1]	Yes	Moderate	No	No
[2]	Moderate	No	Yes	Moderate
[3]	Yes	Yes	No	No
[4]	Moderate	No	Yes	Yes
This Work	Yes	Yes	Yes	Yes

Recent studies show that Artificial Intelligence (AI) and digital transformation are transforming the textile and fashion e-commerce industry. They enhance intelligent business operations, customer engagement, and overall organizational performance [5]. The adoption of AI technologies, including customer behavior analytics, personalized recommendations, and predictive demand forecasting, has significantly improved decision-making, marketing effectiveness, and operational performance in the apparel sector [6]. Furthermore, AI-driven logistics and intelligent supply chain management have enhanced inventory optimization, warehouse operations, route planning, and real-time logistics coordination, leading to improved supply chain responsiveness and customer satisfaction [7]. Sustainable AI applications have also contributed to resource optimization, waste reduction, circular economy practices, and environmentally responsible textile manufacturing, thereby supporting long-term sustainability goals [8].

In addition, AI-enabled marketing intelligence and predictive consumer analytics have strengthened personalized customer experiences, purchasing behavior, and brand loyalty in digital commerce environments [9]. Moreover, the integration of AI-driven industrial innovation with advanced manufacturing and digital commerce technologies has significantly improved productivity, automation, operational efficiency, and sustainable growth in the fashion and textile industry [10]. Most previous studies have examined AI-based marketing, customer behavior, and supply chain optimization independently. This study addresses the research gap by proposing an integrated AI-driven framework that combines AI personalization, demand forecasting, supply chain responsiveness, sustainability, and customer behavior analytics for textile e-commerce. The framework aims to enhance customer engagement, operational efficiency, and long-term sustainable business performance.

3. Key Contributions

1. Developed an integrated AI-driven framework for textile e-commerce by combining digital marketing, consumer behavior analytics, and supply chain optimization.
2. Identified the key factors influencing consumer purchase intention, including trust, perceived value, customer satisfaction, interaction intensity, and emotional engagement.
3. Demonstrated the positive impact of AI-powered personalization, predictive analytics, and supply chain optimization on customer engagement, operational efficiency, and sustainability.
4. Provided practical recommendations to improve customer experience, organizational performance, and long-term competitive advantage.

4. Method, Experiments and Results

Method: The study employed a quantitative cross-sectional research design using primary and secondary data sources. Primary data were collected through a structured questionnaire from textile e-commerce consumers, digital marketing professionals, textile retailers, and supply chain practitioners. Of the 420 questionnaires distributed using convenience and purposive sampling, 386 valid responses were obtained, resulting in a 91.9% response rate. The questionnaire measured key constructs—including trust, perceived value, emotional engagement, customer satisfaction, AI personalization, AI forecasting capability, purchase intention, and supply chain responsiveness—using a five-point Likert scale. Secondary data were obtained from industry reports, e-commerce transaction databases, logistics reports, platform analytics, and peer-reviewed publications from Scopus, Web of Science, IEEE Xplore, and ScienceDirect. The data were thoroughly screened for missing values, inconsistencies, and duplicate responses before statistical analysis.

Statistical analysis

The proposed AI-driven framework was validated using multiple statistical techniques. Descriptive statistics (mean, standard deviation, and variance) summarized respondent characteristics and research variables, while Pearson correlation analysis examined relationships among customer behavior, AI personalization, demand forecasting, and supply chain responsiveness. Multiple linear regression assessed the impact of independent variables on purchase intention and operational performance, with statistical significance evaluated at a 95% confidence level ($p < 0.05$). Hypothesis testing further confirmed the proposed conceptual relationships, ensuring the framework's reliability, validity, and robustness for intelligent decision-making in textile e-commerce.

Experiments

The experimental analysis assessed the effectiveness of AI-driven digital marketing and supply chain optimization in textile e-commerce using survey data from consumers and industry stakeholders. Descriptive statistics, multiple regression, and hypothesis testing were employed to evaluate relationships among the variables. The results confirmed that trust, perceived value, customer satisfaction, AI personalization, and AI forecasting significantly influence purchase intention, customer

loyalty, supply chain performance, and sustainability. Overall, the findings validated the proposed framework and identified the key drivers of customer satisfaction, operational efficiency, and long-term business success.

Results

Descriptive statistics analysis

The descriptive statistics reveal that Perceived Value (Mean = 4.53) and Customer Satisfaction (Mean = 4.47) are the most influential factors affecting consumer purchasing decisions in textile e-commerce, followed by Trust (Mean = 4.41) and Emotional Engagement (Mean = 4.35). Interaction Intensity (Mean = 4.28) and Purchase Intention (Mean = 4.24) also demonstrate strong consumer involvement with AI-enabled shopping platforms. Although AI Personalization (Mean = 4.18) and Supply Chain Responsiveness (Mean = 4.11) received comparatively lower rankings, their positive mean scores indicate that intelligent technologies and responsive supply chain practices play an important role in enhancing customer experience and operational performance. Furthermore, the relatively low standard deviation and variance values across all variables indicate consistent respondent opinions, confirming the reliability of the dataset and highlighting the significance of both consumer-centric and AI-driven operational factors in improving textile e-commerce performance.

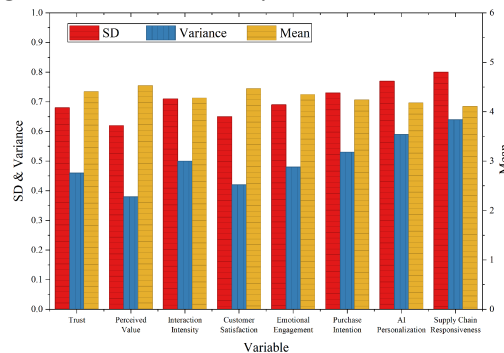


Figure 1 Results of Descriptive statistics

Discussions

The results indicate that perceived value and customer satisfaction are the strongest drivers of consumer purchase behavior in textile e-commerce. Trust, emotional engagement, and interaction intensity further enhance purchase intention and customer loyalty. AI-driven personalization and predictive forecasting significantly improve demand prediction, inventory management, supply chain performance, and operational efficiency. The negative effect of perceived risk highlights the importance of secure transactions and transparent business practices. Overall, integrating AI-driven marketing intelligence with supply chain optimization enhances sustainability, competitiveness, and long-term business success.

Conclusions

This study proposed an AI-driven integrated framework that combines digital marketing intelligence with supply chain optimization to improve customer engagement and operational performance in textile e-commerce. The findings revealed that perceived value, customer satisfaction, trust, AI-based personalization, and predictive demand forecasting positively influence purchase intention, customer loyalty, inventory optimization, and supply chain responsiveness, while perceived risk negatively affects purchasing behavior. The framework effectively integrates customer behavior analytics with intelligent operational decision-making, leading to improved logistics efficiency, sustainable resource utilization, and long-term competitiveness. The study provides strong empirical support for AI adoption in digital commerce, with future research suggested in deep learning-based recommendation systems, blockchain-enabled supply chains, explainable AI, and real-time longitudinal analytics.

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