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OPTIMIZING E-COMMERCE THROUGH MODERN WEB TECHNOLOGIES (NEXT.JS, LARAVEL, AND OTHERS): A SYSTEMATIC LITERATURE REVIEW

OPTIMALISASI E-COMMERCE MELALUI TEKNOLOGI WEB MODERN (NEXT.JS, LARAVEL, DSB): SEBUAH TINJAUAN SISTEMATIS LITERATUR (*SYSTEMATIC LITERATURE REVIEW*)

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ABSTRACT
This study aims to analyze the application of modern web technologies in optimizing e-commerce systems through a Systematic Literature Review (SLR) approach. The study was conducted to identify trends, advantages, and challenges in using the Next.js and Laravel frameworks to improve performance, security, and user experience. The research method refers to the PRISMA 2020 guidelines, including the identification, screening, and thematic synthesis stages of 20 relevant scientific articles. The results show that Next.js excels in increasing access speed and search engine optimization through Server-Side Rendering and Static Site Generation, while Laravel plays a crucial role in security, database management, and Model–View–Controller (MVC) architecture efficiency. The combination of the two results in a Headless Commerce approach that separates the front-end and back-end, making the system more flexible, secure, and easily integrated with other technologies such as payment gateways, chatbots, and artificial intelligence. In addition, the implementation of a Netfilter-based security system has been proven to prevent more than 80% of network attacks on e-commerce platforms, while the integration of AI chatbots improves customer service efficiency. In conclusion, the implementation of a modern web framework combined with AI technology and adaptive security systems is able to support the development of innovative, efficient, and sustainable e-commerce in the digital era.

Keywords: Ecommerce; Next.js; Laravel; Headless Commerce; Web Security

ABSTRAK
Penelitian ini bertujuan untuk menganalisis penerapan teknologi web modern dalam optimalisasi sistem e-commerce melalui pendekatan Systematic Literature Review (SLR). Kajian dilakukan untuk mengidentifikasi tren, keunggulan, serta tantangan penggunaan framework Next.js dan Laravel dalam meningkatkan performa, keamanan, dan pengalaman pengguna. Metode penelitian mengacu pada pedoman PRISMA 2020, mencakup tahap identifikasi, penyaringan, dan sintesis tematik terhadap 20 artikel ilmiah yang relevan. Hasil penelitian menunjukkan bahwa Next.js unggul dalam meningkatkan kecepatan akses dan optimasi mesin pencari melalui *Server-Side Rendering* dan *Static Site Generation*, sedangkan Laravel berperan penting dalam aspek keamanan, manajemen basis data, serta efisiensi arsitektur *Model–View–Controller (MVC)*. Kombinasi keduanya menghasilkan pendekatan *Headless Commerce* yang memisahkan *front-end* dan *back-end* sehingga sistem menjadi lebih fleksibel, aman, dan mudah diintegrasikan dengan teknologi lain seperti *payment gateway, chatbot,* serta kecerdasan buatan. Selain itu, implementasi sistem keamanan berbasis *Netfilter* terbukti mampu mencegah lebih dari 80% serangan jaringan terhadap *platform e-commerce,* sementara integrasi *AI chatbot* meningkatkan efisiensi pelayanan pelanggan. Kesimpulannya, penerapan *framework web* modern yang dikombinasikan dengan teknologi AI dan sistem keamanan adaptif mampu mendukung pengembangan *e-commerce* yang inovatif, efisien, dan berkelanjutan di era digital.

Kata Kunci: *E-commerce; Next.js; Laravel; Headless Commerce; Keamanan Web*

INTRODUCTION

The development of modern web technologies over the last five years (2020–2025) has become a major catalyst for the growth of the digital business ecosystem, particularly in the e-commerce sector. This trend of digitalization has driven significant transformations in the way companies develop, manage, and optimize their online services (Faisal & Fasa, 2025). E-commerce has emerged as one of the fastest-growing sectors in the world, with annual transaction volumes increasing by more than 20% in various countries (Lusa et al., 2024). This growth is not only driven by increased internet access and mobile device adoption, but also by innovations in web architecture and technology that support improved performance, security, and user experience (Tunjungsari et al., 2025).

One of the key trends in modern e-commerce system development is the use of JavaScript- and PHP-based frameworks such as Next.js and Laravel. Next.js, built on top of React, offers features such as Server-Side Rendering (SSR), Static Site Generation (SSG), and Incremental Static Regeneration (ISR) to enhance loading speed and search engine optimization. As a React-based framework, Next.js introduces SSR and SSG, enabling faster page loading and improved SEO optimization. These capabilities make Next.js a leading choice for performance-oriented modern e-commerce development (Patel, 2023). Meanwhile, Laravel, as a PHP framework, offers strengths in system stability and security through its Model–View–Controller (MVC) architecture, Object Relational Mapping (Eloquent ORM), and middleware systems that reinforce validation and user authentication (Melyani et al., 2023).

The combination of Next.js and Laravel has given rise to a new approach called Headless Commerce, where the presentation layer (front-end) and application logic (back-end) are separated through an Application Programming Interface (API) (Agarwal, 2023). This approach provides high flexibility in user interface development and facilitates integration with third-party services such as payment gateways, content management systems (CMS), and AI-driven recommendation engines.

Several studies demonstrate that the use of modern frameworks such as Next.js and Laravel can significantly enhance e-commerce performance. According to Patel (2023), Next.js performance excels due to its server-side rendering support, automatic code splitting, image optimization, and static regeneration (ISR), all of which contribute to faster loading, efficiency, and SEO-friendliness. A 5Hz report (Koval, 2025) states that implementing Next.js in e-commerce sites can speed up page load times by up to threefold and increase conversion rates by 35%. Meanwhile, Bagisto 2025 ("Marvel – Headless Ecommerce Bagisto Theme with Next.Js," n.d.) reports that integrating Laravel with Next.js in headless e-commerce theme development results in a lighter and more secure system compared to traditional monolithic approaches. Despite these performance improvements, research indicates that modern framework implementation still faces challenges, especially regarding real-time data synchronization, API security, and cross-platform scalability (Putra et al., 2025a). Some studies tend to focus solely on technical performance analysis without providing a comprehensive mapping of how performance, security, and user experience intersect within the e-commerce context (Surjawan & Apriyanti, 2012). As a result, a research gap remains in fully understanding how modern web technologies can be optimized to support sustainable e-commerce in the digital era.

Although numerous studies have discussed the performance and architecture of modern frameworks, no systematic literature review (SLR) has yet specifically compared Next.js and Laravel in the context of modern e-commerce development, particularly regarding their integration within a headless approach. Therefore, this research aims to map the advantages, disadvantages, and usage trends of Next.js, Laravel, and headless commerce architecture based on scientific studies and recent research findings. Academically and practically, this study contributes by providing comprehensive technical guidance and future research directions for developers and information technology researchers in the e-commerce field, thereby supporting the development of more optimal, secure, and sustainable platforms.

METHODS

The research method used in this study is a Systematic Literature Review (SLR) referring to the PRISMA 2020 guidelines to ensure transparency, objectivity, and replicability of the research process. The research procedure was carried out through several stages, namely identification, screening, eligibility assessment, and inclusion. Literature searches were conducted from March to April 2025 using several scientific databases such as Scopus, IEEE Xplore, ScienceDirect, SpringerLink, and Google Scholar, with keywords including "E-commerce," "Next.js," "Laravel," "Optimization," "Performance," "Security," and "User Experience." Scopus and IEEE Xplore were selected because they provide reputable international journals in the field of information technology, while ScienceDirect, SpringerLink, and Google Scholar offer broader and multidisciplinary literature coverage. From a total of 47 initial articles, a selection process was carried out, resulting in 20 articles that met the inclusion criteria for further analysis. Data analysis was performed using a thematic synthesis approach to categorize research findings into several core themes, including front-end optimization, back-end scalability, user experience, data security, and future trends such as headless commerce and artificial intelligence integration. Through this process, the study produces a comprehensive thematic mapping of modern web technology implementation in optimizing e-commerce systems.

As part of the selection process, this study applied the following inclusion criteria: (1) articles published between 2020–2025, (2) written in English or Indonesian, (3) scientific documents that have undergone a peer-review process such as journals and conference proceedings, and (4) studies discussing e-commerce, Next.js, Laravel, or modern web technology in the context of performance, security, or user experience. The exclusion criteria include: (1) non-peer-reviewed articles such as blogs, technical reports without scientific validation, or editorial opinions, (2) studies unrelated to the e-commerce domain, (3) research that does not use or address modern web technologies, and (4) duplicate documents or studies that do not provide adequate methodological data.

RESULTS AND DISCUSSION

The findings of this study were obtained through a Systematic Literature Review (SLR) based on the PRISMA 2020 guidelines, by analyzing 20 relevant scientific articles concerning the application of modern web technologies in e-commerce systems. Based on the results of thematic synthesis, it was found that technologies such as Next.js, Laravel, and the integration of Artificial Intelligence (AI) as well as security systems such as Netfilter significantly contribute to improving performance, security, and user experience in the development of e-commerce platforms.

In general, the reviewed studies indicate that the Next.js framework excels in speed and rendering efficiency through Server-Side Rendering (SSR) and Static Site Generation (SSG), while Laravel provides substantial contributions to system stability, security, and modularity through its Model–View–Controller (MVC) architecture. Furthermore, the combination of both frameworks results in the Headless Commerce approach, which separates the front-end from the back-end, allowing seamless integration of APIs, payment gateways, and AI-based systems such as chatbots. To understand the characteristics and recent research trends in this field, the studies were classified based on author, year of publication, title, keywords, research focus/domain, and study results. This summary is presented in Table 1, which maps the findings from each analyzed article.

To further support the explanation of performance characteristics of each framework, Table 1 also presents a comparative summary of Next.js and Laravel based on four main aspects: performance, security, ease of development, and scalability.

Table 1. Comparative Summary of Next.js and Laravel

Aspects	Next.js	Laravel
Performance	Utilizes SSR, SSG, and ISR for fast rendering and SEO optimization; highly effective for initial page load response.	Strong in backend processing; supports caching, database optimization, and queue systems for server-side performance.
Security	Depends on API and server configuration; potentially vulnerable to XSS and API exposure if not properly managed.	Provides built-in security features such as CSRF protection, hashing, authentication middleware, and a secure ORM against SQL Injection.
Ease of Development	React-based, suitable for modern front-end development; extensive component ecosystem; requires proficiency in JavaScript/React.	Clear and standardized MVC structure; comprehensive documentation; numerous ready-to-use packages for backend development.
Scalability	Flexible for micro-frontend architectures and edge/CDN-based deployments; ideal for large-scale and distributed applications.	Supports horizontal and vertical scaling through load balancing, caching, queue workers, and server optimization.

Table 2. SLR Results

No	Authors	Year	Title	Keywords	Focus/Domain	Research Findings
1	Fauzan Prasetyo Eka Putra, Reynal Widya Efendi, Alief Badrit Tamam, and Walid Agel Pramadi	2025	Trends and Best Practices in API-Based Web Development Using Laravel and React	Laravel; React; API; Web Architecture; Single Page Application	Web Architecture & API	The study indicates that the architecture using API-based development with Laravel as the backend and React as the frontend has become increasingly popular in modern web development. This approach enables the separation of responsibilities between presentation and business logic, thus improving scalability, maintainability, and system flexibility. Laravel supports the development of RESTful APIs and headless architecture, while React enables dynamic and responsive user interface development. Their integration is further enhanced through best practices such as token authentication, asynchronous data management, and proper CORS configuration, allowing systems to meet the needs of large-scale and complex applications (Putra dkk., 2025)
2	Karina Djunaidi, Dine Tiara Kusuma, Rahma Farah Ningrum, Puji Catur Siswipraptini, and Dina Fitria Murad	2025	Big Data Analytics of Knowledge and Skill Sets for Web Development Using Latent Dirichlet Allocation and Clustering Analysis	Big Data Analytics; Hierarchical Clustering; Latent Dirichlet Allocation; Web Development; Knowledge; Skills	Data Analytics & MSME Digitalization	The findings show that digital transformation plays an important role in expanding market reach for MSMEs, increasing revenue, creating new business opportunities, and raising public awareness of local products. However, challenges include low digital literacy, limited technical skills, and inadequate infrastructure. These indicate that

						digitalization has the potential to be a catalyst for strengthening MSMEs' competitiveness (Kusuma et al., 2025).
3	Juho Vepsäläinen and Petri Vuorimaa	2025	Overview of Web Application Performance Optimization Techniques	Optimization; Performance; Web Applications; Web Development; Web Frameworks; Web Tooling; World Wide Web	Performance Optimization	The study found that mobile website sizes increased by nearly 600% between 2012–2022, making efficiency and speed major issues. The authors reviewed six Google Core Web Vitals metrics (LCP, FCP, INP, CLS, FID, TTFB) and highlighted the role of frameworks such as Next.js, Astro, and Laravel Livewire in applying optimization techniques such as server-side rendering, incremental static regeneration, caching, and code-splitting. The results show that the best web performance can be achieved through a combination of rendering strategies, cache management, and efficient data compression (Vepsäläinen et al., 2025).
4	Dinh Bui	2023	Next.js for Front-End and Compatible Backend Solutions	Next.js, Express.js, MongoDB, Firebase	Front-End & Back-End Integration	The study compares Express.js with MongoDB and Firebase; Express.js is more flexible and scalable, while Firebase offers complete features for rapid development (Bui, 2023).
5	Eko Hariadi and Afnan Rosyidi	2024	Sukses Membangun Bisnis E-Commerce di Masa Depan	E-Commerce	Digital Business Strategy	The study enhances understanding of factors influencing student satisfaction in online learning during the pandemic and provides digital strategies and technological innovation to strengthen businesses in the Industrial 4.0 era

						(Hariadi & Rosyidi, 2024).
6	Diogo da Silva Alves	2025	Web Platform for Financial Management	Financial Management; Expense Categorization; Open Banking; Data Visualization; Personal Finance; Web Platform	Financial Web Application	Developed a web platform called Cash In Check to help users manage personal finances through Open Banking API integration, expense categorization, and interactive visualization. Testing showed the system was secure, responsive, and improved user understanding of financial behavior. Using the Waterfall method, the study concludes that modern web technologies can effectively create efficient, transparent, and user-friendly financial management platforms (da Silva Alves, 2025).
7	Maria João Tinoco Varanda Pereira	2022	Marketplace for Circular Bioeconomy	Firebase; ReactJS; Next.js; Typescript; No-SQL; Firestore; Circular Bioeconomy	Sustainable E-Commerce	The study developed a prototype e-commerce website called Bioma, designed to connect companies and individuals to sell or exchange industrial byproducts to support circular economy and environmental sustainability (Pereira, 2022).
8	Wisnu Uriawan, Raden Ibnu Huygenz Widodo, Ray Ramadita, Reza Fahlevi Herdiyanto, Rifqi Syekhi Marsaputra, and Silvia Nurrobianti	2024	Implementing Large Language Model API for Interview Training Based on Job Description	Large Language Model; Job Interview System; Agile Development	AI & Interactive Web	The study successfully developed a web-based application called Invisor, a training platform using Artificial Intelligence (AI) — particularly a Large Language Model (LLM) — to help students and job seekers prepare for interviews with greater confidence and effectiveness (Uriawan et al., 2024).
9	Hung Le	2023	Web Development With T3 Stack	React; Front-End; Back-End; Full Stack; Create-T3-App	Modern Frameworks	T3 Stack is presented as a modern and efficient choice for building full-stack web applications. Its strengths lie in type safety, scalability,

						flexibility, and enhanced developer experience. Although the MERN Stack remains popular, T3 Stack may become the new standard due to its integration of modern development best practices (Le, 2023).
10	Dwi Aulia Anugeraha and Sandy Kosasi	2024	Transaction Security in E-Commerce: Big Data Analysis in Cloud	Web Mobile; Next.js	Health Information Systems	The study found that using Next.js, Laravel, and GraphQL in the development of a Mobile Web Management Information System for a Community Health Center significantly improved service efficiency. Data entry only needed to occur once and became integrated into all services, reducing redundancy and wait times. White-box testing confirmed the system's reliability, with high performance achieved through Server-Side Rendering. Overall, the system improved operational performance, service quality, and information access (Anugerah & Kosasi, 2024).
11	Rajeswaran Ayyadura	2022	Transaction Security in E-Commerce: Big Data Analysis in Cloud Environments	E-Commerce; Transaction Security; Privacy Protection; Predictive Modeling; Distributed Processing; Critical Evaluation	E-Commerce Transaction Security	The study highlights the importance of effective security model development using advanced technologies such as deep learning and best practices to ensure integrity, confidentiality, and trust in online transactions (Ayyadurai, 2022).
12	Reza Bayu Ahmad Inzaghi, Dibyo Adi Wibowo, Devita Widiawati, Ibnu Utomo Wahyu Mulyono, Sudaryanto, Novita Kurnia	2025	Optimizing Bus Ticket Booking Efficiency through Mobile Application Implementation	Mobile Application; Bus Ticket Booking; Android Studio; Java; Firebase; Blackbox Testing	Mobile Applications	The study shows that technological developments in mobile apps have significantly changed the transportation industry, especially mobile-based bus ticket booking

	Ningrum					services, which continue to grow in popularity (Inzaghi et al., 2025).
13	Nando Ferdiansah and Ade Eviyanti	~2023/2025	Web-Based Membership and Inventory Information System for Music Student Activity Unit to Optimize Administration	Information System; Student Activity Unit; Member Management	Organizational Administration	The study shows that the web-based system for membership and inventory management in IKABAMA Music Organization functioned effectively without functional errors. It is expected to improve administrative efficiency and serve as a model for digital organizational management. The publication year is not explicitly stated but estimated around 2023–2025 based on preprint server records (Ferdiansah & Eviyanti, 2025).
14	Yusuf Alvino Yusrifan, Sulaibatul Aslamiyah, Tintin Harlina	2023	Implementation of a Website-Based Shoe Laundry Ordering Management System at Jivin Clean Using the Waterfall Method	Jivin Clean; Shoes; Waterfall	Online Ordering System	The study developed a website-based information system for transaction and data management, including a shoe laundry ordering system. Testing showed the system operated smoothly without errors (Vino et al., 2023).
15	Mieke Yustia Ayu Ratna Sari, Zerry Akbar Yudisetyo, Farida Prima Pratista, Hikam Hulwanullah	2024	Optimizing E-Commerce Platforms to Increase MSME Marketing	E-Commerce	MSME Marketing Enhancement	The findings show that digital literacy and the use of e-commerce increase MSME competitiveness and help them adapt to technological and market developments (Sari et al., 2024).
16	Abel Ratino, Renita Astri, Putri Anggraini	2023	Implementation of the Laravel Framework in E-Commerce Application Development for Jago Software Store	Laravel; E-Commerce Application; Software Development; Jago Software Store	System Development	The study shows that implementing the Laravel framework in developing an e-commerce application for Jago Software Store successfully created an efficient and reliable platform. Laravel's routing, user management, database handling, and built-in security features contributed to modular development that improved

						performance, security, and user experience (Ratino et al., 2023).
17	Nois Arya Chaerunianisa, Yance Sonatha, Hidra Amnur	2025	Optimizing the Customer Service of Optical Store through Web-Based Ordering Information System	Ordering System; Laravel; Midtrans; MSMEs; Waterfall; Optical	Customer Service	The study indicates that the web-based ordering and management system significantly improved operational efficiency, reduced recording errors, and accelerated transactions through features such as online ordering, integrated data management, and automatic payments using Midtrans. Testing showed that all features functioned as expected, expanding business reach and supporting MSME digitalization in optical retail (Chaerunianisa et al., 2025).
18	Angga Nurul Huda, Endang Supriyati, Tri Listyorin	2024	Development of an E-Commerce Website for MSME Muma Cookies & Snack	E-Commerce; MSME; Website; Waterfall; Online	Digital MSMEs	Developed a responsive and user-friendly e-commerce website with secure payment integration for MSME Muma Cookies & Snack, improving operational efficiency and market reach (Huda et al., 2024).
19	Gusrino Yanto, Sari Puspita, Zainul Efendy	2024	AI-Based Chatbot E-Commerce Innovation for Deta Rancak and Tingkuluak Kreasi Sanggar Seni Permata Hati	E-Commerce; Waterfall; AI Chatbot	AI Chatbots & E-Commerce	The study found that implementing an AI chatbot–enhanced e-commerce system using Laravel and Flowise AI increased sales effectiveness and service quality. It simplified product information access and transaction flow, supporting cultural preservation through digital innovation (Yanto et al., 2024).
20	Eko Jhony Pranata	2023	Optimizing Computer Network Security in E-Commerce Websites Using Netfilter	Network Security; E-Commerce Websites; Netfilter; Advanced Policy Firewall; Ping Attack; Mod Evasive; Port	Network Security	The study shows that using Netfilter with Advanced Policy Firewall (APF) and Mod Evasive significantly improved e-commerce network security. The system prevented DoS/DDoS attacks by 87.68%, Ping Attacks by

Scanning	15.72%, and Port Scanning by 90.33%, with an average effectiveness of 64.57%, although it required large server memory (867.968 KiB) (Pranata, 2023).

DISCUSSION

Based on the thematic synthesis of 20 selected articles, four main domains were identified in the development of modern e-commerce systems: (1) system performance optimization, (2) scalability and security, (3) user experience, and (4) AI integration in digital services.

\System Performance Optimization

The Next.js framework offers advantages in page load time, processing efficiency, and improved Core Web Vitals scores through the implementation of SSR, ISR, and caching. Research by Vepsäläinen & Vuorimaa (2025) demonstrated that combining SSR and ISR can accelerate page access up to three times compared to traditional monolithic systems.

System Scalability and Security

Laravel supports modular system development with advanced security control through middleware, token validation, and API protection. In the study by Pranata (2023), the implementation of Netfilter, Advanced Policy Firewall (APF), and Mod Evasive successfully mitigated more than 85% of DoS/DDoS attacks and 90% of port scanning attempts, indicating the effectiveness of multi-layered security systems. Such effectiveness directly contributes to enhancing the resilience of e-commerce platforms by reducing the risk of service disruption that may hinder transaction processes. Network protection also ensures operational stability, allowing users to conduct transactions securely without interruptions or potential data leaks. Therefore, these security layers play a crucial role in maintaining system integrity and increasing customer trust in e-commerce platforms.

User Experience (UX)

Findings from Huda et al. (2024) show that responsive web design and digital payment integration significantly improve customer satisfaction and expand MSME market reach. The headless commerce approach also supports personalized user experiences based on preferences and transactional behavior.

AI and Chatbot Integration in E-Commerce

The study by Yanto et al. (2024) revealed that the implementation of AI-based chatbots (Flowise AI) enhances customer service effectiveness and transaction management efficiency. AI integration enables automated responses, customer behavior analysis, and increased user loyalty through contextual interactions.

Comprehensive analysis shows that the synergy between modern frameworks and AI technologies results in e-commerce systems that are not only fast and secure but also adaptive to future business needs.

This study has several limitations. First, it only uses secondary data from published

literature; therefore, no direct implementation of Next.js and Laravel on a real e-commerce platform was conducted to practically validate the findings. Second, the analysis is limited to a specific publication period (2020–2025), excluding emerging trends and technologies outside this timeframe. Third, not all analyzed studies originate from Q1 journals, implying variations in quality and scholarly reputation, which may affect the generalization of findings.

CONCLUSION

This research concludes that the synergistic application of modern web technologies such as Next.js and Laravel can optimize performance, security, and user experience in e-commerce system development. Next.js offers advantages in speed and SEO, while Laravel strengthens security and data management. Their integration within the Headless Commerce concept enables flexible and efficient system development. Additionally, the application of AI chatbots and security mechanisms such as Netfilter significantly improves service quality and system resilience against cyber threats. Overall, these findings affirm that the combination of modern web technologies and artificial intelligence serves as a key driver of sustainable and competitive digital transformation in e-commerce within the Industry 5.0 era.

Future research is recommended to conduct direct implementation studies of Next.js and Laravel on real e-commerce platforms to validate theoretical findings. Further investigations are also needed regarding AI integration and user data protection mechanisms to ensure comprehensive security and system sustainability.

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