IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"Empowering Retailers With Iot: Opportunities, Benefits, And Challenges For Improved Customer Experience And Operational Efficiency"

Zunaith Ahmed
Assistant Professor
College of Economics, Management and Information Systems
University of Nizwa

Abstract:
The global retail industry has undergone significant transformations in the last ten years, driven by advancements in automation and the increasing use of the internet and mobile devices, which have altered consumer shopping habits. Consequently, global retailers face intense pressure to adapt to these changes, leading many to embrace digital technologies aimed at enhancing customer service and cutting costs. This study aims to analyze the challenges and opportunities of implementing IoT in the retail sector. Based on literature review, the research concludes that the use of IoT in retail firms can result in increased revenue, enhanced operational efficiency, improved channel integration, optimized supply chain management, and an elevated customer shopping experience. The study provides guidance for retailers to utilize IoT applications and succeed in a changing consumer landscape. However, retailers must be cautious in considering the security and privacy implications of collecting and utilizing customer data generated by IoT devices. The future of retail will be shaped by the blending of physical and digital worlds. Using IoT (Internet of Things) is crucial for retailers, not just a passing trend. Although there are costs involved, the clear advantages include better supply chain management and improved customer experiences driven by IoT. Retailers who delay adopting IoT may miss out on these opportunities.

Keywords: Internet of Things, Customer experience, Operational efficiency, Digital transformation in retail sector.

Introduction to IoT in Retail:

"Internet of Things" (IoT) refers to a network of physical objects that are embedded with unique identifiers (UIDs), sensors, software, and other technologies, enabling them to connect and exchange data with other devices and systems over the internet. As per IMARC Group's report, the global IoT in retail market attained a value of $49.5 billion in 2022. The projection suggests the market will achieve a valuation of $147.0 billion by 2028, reflecting a compound annual growth rate (CAGR) of 18.2% from 2023 to 2028. According to a Statista report from 2020, it is projected that by 2030, the number of connected devices will reach 29.4 billion. The IoT industry is rapidly expanding and has diverse applications in various sectors, including manufacturing, healthcare, transportation, energy, and retail. To remain competitive and enhance productivity and efficiency, the retail industry has begun investing more in IoT. A McKinsey report from 2021 suggests that the use of IoT in physical retail environments has a monetary value ranging from $0.6 trillion to $1.1 trillion, representing 9 to 12 percent of the potential monetary value across all settings. The majority of the economic value contribution, 62 percent, is from developed markets. Maier's (2016) study concludes that the marketing value of IoT applications is highest

in the retail industry compared to other domains. Retailers utilize IoT to collect valuable information, generate real-time reports, and continuously monitor data, which can assist them in making informed decisions, improving profitability, and enhancing the shopping experience for customers in a competitive market. Dasgupta, Nagaraj, and Nagamani (2016) state that the adoption of Internet of Things devices by consumers is rapidly increasing. The study suggests that about 66% of consumers intend to purchase a connected home device by 2019.As per the Data Journalism team's analysis, the percentage of retail businesses recruiting for internet of things (IoT) related roles in July 2022 remained relatively stable in comparison to the same period in the previous year. Meanwhile, a PWC report has revealed that 94% of retailers are of the opinion that the benefits of IoT outweigh the associated risks, and are therefore exploring ways to integrate it into their operations.

Overview of IoT Technologies in Retail

The retail sector is undergoing a rapid transformation due to increasing automation. Some key IoT application in retail include:

- **Smart digital signage:** These system tailor's advertisements to customers' preferences enhancing the effectiveness of marketing efforts.
- **Smart shelves:** Equipped with sensors and RFID tags enhance inventory tracking and security measures. Ensuring that shelves are stocked and reducing the risk of theft.
- **Facial recognition:** This technology helps in identifying potential shoplifters, thus enhancing store security, improving shopping experience.
- **Interactive robots:** These robots assist customers with inquiries and navigation within the store, improving the shopping experience.
- **Internet of Things (IoT) sensors** enable features such as locating shopping carts and real-time data streaming for insights into customer behavior.
- **Smart lighting:** improves energy efficiency by adjusting lighting based on store occupancy and natural light availability.
- **Bluetooth Beacons:** attract potential shoppers with personalized offers and inform in-store customers of discounts.
- **Environmental sensors:** monitor conditions for optimal storage, reducing waste, particularly in food retail.
- **Predictive maintenance via IoT**: ensures equipment reliability by predicting maintenance needs, reducing downtime, and extending the lifespan of store equipment.
- **Cashier-less payment systems and interactive terminals**: enhance customer satisfaction and footfall, complemented by smart vending machines and automated checkout options.

These IoT technologies collectively enhance the operational efficiency, customer experience and security in the retail sector, helping retailers stay competitive in an increasingly digital and connected world.

Research Methodology:

This study adopts a non-systematic literature review (Non-SLR) approach to analyze the opportunities, benefits, and challenges of implementing IoT technologies in the retail sector, with a focus on enhancing customer experience and operational efficiency. The literature review was conducted over a six-month period from January 2023 to June 2023. During this time, an extensive search was carried out across a range of academic and industry-specific databases, including Scopus, Taylor & Francis, Springer, Elsevier, ACS Digital Library, Wiley, IEEE Xplore, ScienceDirect, JSTOR, Google Scholar, EBSCOhost Business Source Premier, ProQuest Business databases, and Statista. The selection of literature was guided by relevance to the research objectives rather than strict inclusion/exclusion criteria, with keywords such as "Internet of Things," "IoT in retail," "customer experience," and "operational efficiency." The gathered literature was qualitatively analyzed to identify common themes, emerging trends, and key challenges, with the findings synthesized in a narrative format.

Literature Review:

Changing Retail landscape and the application of Internet if things in the retail industry:

A report by Nielsen IQ (2022) has highlighted that the retail landscape, particularly in the fast-moving consumer goods (FMCG) sector, has undergone significant changes during the pandemic, and is expected to continue evolving as consumers shift their retail channel preferences due to rising prices and supply chain disruptions. The adoption of digital technologies has enabled retailers to better serve customers in a cost-effective manner. The global digital transformation market in the retail industry was valued at 143.55 billion USD in 2020 and is projected to reach 388.51 billion USD by 2026. As a result of these technological advancements, companies are

increasingly realizing the need to adjust their strategies and business models to create more value for customers. A McKinsey (2020) report suggests that a larger proportion of consumers will make purchases online in the post-COVID era. To remain competitive, retailers need to adopt IoT to improve their efficiency and profitability, as emphasized by Končar et al. (2020). A nosto research report found that 83% of consumers expect retailers to provide more personalized shopping experiences. The availability of low-cost sensors, reduced data collection costs, and the affordability of IoT hardware and software have enabled even small retailers to invest in IoT technology. Additionally, as Forbes notes, robots are expected to play a more significant role in retail operations, interacting with employees and customers alike as AI technology becomes more advanced.

IoT Innovations Transforming In-Store Experience

According to the research conducted by Al-Nabet, N. S. (2021), it was discovered that in Qatar, IoT devices including sensors, scanners, beacons, smart shelves, personalization alerts, and RFIDs are being employed by retailers to facilitate their critical business operations and processes. The research conducted by Krishita et al. (2022) revealed that implementing the Clever Cart IoT device in retail stores can reduce the need for direct human interaction in grocery stores, issue reminders for items to be bought, and minimize queue waiting time. Meenu (2022) reported that retail companies have recognized the importance of focusing on customer experience and personalization to increase their revenues. Given that **customer engagement** is a crucial factor in today's retail industry, many retailers have adopted technologies such as AI and augmented reality to **enhance** it. In contrast, according to Adam Pierko's (2021) research findings, the fast-paced retail sector generates a wealth of instantaneous new data. Implementing real-time analytics and processing technologies can be incredibly advantageous, guiding retail businesses towards making decisions based on valuable insights that can amplify their profits. Raji et al. (2024) highlight that adopting technologies like artificial intelligence, machine learning, and edge computing can enhance real-time data analytics, improving both operational efficiency and personalized customer experiences. The study underscores the necessity of these investments for maintaining a competitive edge in retail. Mike Thomas (2022) stated that as the Internet of Things (IoT) continues to expand, customers will have access to a more integrated and intelligent shopping experience that interconnects the physical and digital domains through a system of devices such as stores, software, and vehicles. Walmart CEO Doug McMillon notes that the adoption of the internet of things, drones, delivery robots, 3D-printing and self-driving cars will enable retailers to automate and optimize their supply chains, resulting in significant changes to both the demand and supply sides of the equation. Walmart's VP of Global Tech, Sanjay Radhakrishnan (2021), emphasized their extensive and unmatched use of IoT for transformative outcomes in retail. They deploy IoT extensively, enhancing food quality, energy efficiency, and cost-effectiveness. With 7 million IoT data points across U.S. stores, they transmit 1.5 billion daily messages about temperature, operations, and energy. Advanced algorithms enable real-time anomaly detection, benefiting all 4,600+ U.S. stores for improved customer service and cost reduction.

According to a report by SAS, Dan Mitchell (2022) states that as online shopping continues to rapidly grow, retailers are eager to replicate the seamless customer experience of online shopping in their physical stores as much as possible. Retailers are seeking access to the same sophisticated data and high-performance analytics that they use for their websites and mobile shopping experiences. Their objective is to have unrestricted control to create a customized customer experience and gather precise data to assist them in predicting customers' shopping behaviors. Lazaris, Vrechopoulos, and Doukidis' (2017) study revealed that the adoption of IoT in the retail industry is driving a transformation that allows retailers to acquire valuable information, receive real-time reporting, and conduct continuous monitoring. This transformation has the potential to improve the customer experience and increase revenue. Furthermore, the study found that traditional stores can enhance their retail landscape and store atmosphere through Omni-channel retailing, which is made possible by IoT adoption.

Chung and Tan (2024) investigate the impact of digital twin technology in virtual fitting rooms (VFRs) on customer experiences in the retail sector. Their findings indicate that factors such as ownership control and self-efficacy play a crucial role in shaping purchase intentions within IoT-driven VFRs. The study emphasizes the importance of IoT in offering managers a deeper understanding of customer behavior, enhancing the personalization of shopping experiences. These insights are valuable for improving decision-making in retail environments. Vučenović (2018) suggests that modern retail stores have been able to enhance

the consumer purchasing experience and reduce costs by leveraging the Internet of Things (IoT). The study further emphasizes that the IoT is likely to have a significant impact on the future of retail businesses. Adhicandra (2024) highlights how IoT technologies like smart shelves, RFID tags, and cashier-less systems are revolutionizing retail by enhancing customer experiences and streamlining operations. The research shows that IoT-driven innovations lead to better inventory management, personalized marketing, and seamless shopping, ultimately boosting customer satisfaction and loyalty. IoT's role in digital transformation is essential for improving efficiency and value creation in retail. According to Balaji and Roy's (2017) study, the adoption of IoT by retailers has transformed the customers' shopping experience and led to value co-creation. The study also demonstrates that value co-creation has an impact on customers' intentions to continue shopping and share positive experiences through word-of-mouth.

In their research to investigate the role of IoT in the consumer decision-making process, Park and Jeong (2021) found that the application of IoT in the retail industry offers both functional and epistemic value to consumers during the decision-making process. The study by C. O. Chan, H. C. W. Lau, and Y. Fan (2018) discovered that fashion retailers who implement IoT can predict customer purchase intentions by tracking in-store customer behavior, which can be valuable for supply chain planning. Kamble et al. (2019) found that the utilization of Internet of Things (IoT) in food retailing is in its early stages. The research indicates that inadequate government regulations and internet infrastructure are the primary factors driving the adoption of IoT. Nevertheless, the study also demonstrates that IoT can enhance the operational efficiency of food retailers by minimizing waste, reducing energy consumption, and preserving the quality of food. Cong, Li, and Zhang (2021) identified in their research that the retail sector has gained power through the adoption of Internet of Things (IoT) technology, and the acceleration of digital transformation has prompted retailers to modify their strategies correspondingly. According to the study by Caro and Sadr (2019), the implementation of Internet of Things (IoT) supports retailers in integrating channels and improving supply management. De Vass, Shee, and Miah (2018) employed structural equation modeling (SEM) and discovered that the integration of IoT-enabled processes in the retail industry can improve performance at both the supply chain and organizational levels. A study conducted by Khan, Ahmad, and Jamshed (2021) found that the application of IoT can assist online food retailers in comprehending the purchasing decisions of customers and increasing their trust in the retailer. According to a study by De Vass, Shee, and Miah (2021) that investigated the advantages of adopting IoT in the Australian retail industry, IoT applications can enhance the financial, social, and environmental sustainability of retail companies. Caro and Sadr (2019) study reveals that Internet of Things helps retailers in channel integration and enhances supply management.

IoT Success Stories: Companies Embracing Connected Technology in Action"

Sanjay Radhakrishnan (2021), Walmart's VP of Global Tech, highlighted their extensive use of IoT for transformative purposes. They utilize IoT on an unmatched scale in retail, enhancing food quality, energy efficiency, and cost-effectiveness. Walmart currently oversees 7 million IoT data points in their U.S. stores, transmitting around 1.5 billion messages daily about temperature, operations, and energy. Their IoT team has developed specialized software with advanced algorithms for real-time anomaly detection and swift issue resolution. This approach extends to all 4,600+ U.S. stores, aiming to enhance customer service and reduce costs.

Bosch, a home and kitchen appliance tech company, highlights additional IoT applications in food retail, such as notifications from reverse vending machines and parking lot monitoring. Bosch's IoT Suite can alert store managers or information desks when parking lots are full, indicating increased store foot traffic, prompting the need for extra cashiers.

Amazon's Echo Look app employs depth and trend sensing, analyzing full-length selfies for sizing and suggesting appropriate clothing purchases. It features AI-powered tools like Style Check, using machine learning for fashion feedback and outfit recommendations. The app proposes clothing based on user preferences and facilitates virtual try-ons. Alexa provides an intimate view of customers' fashion choices, propelling Amazon to lead US clothing sales in just four years. With Alexa, users can establish a personal fashion showroom, try on clothes, place orders, and receive rapid deliveries, revolutionizing shopping convenience and aiding Amazon's market dominance.

Tim Denman and Jamie Grill-Goodman (2021) Target employs IoT-driven beacons to gather user information and deliver hyper-personalized content. Users can install the Target mobile app on iOS or Android to receive tailored product suggestions aligned with their store section. Notifications are organized like a newsfeed, prioritizing content relevance based on the shopper's current location in the store. This strategy enhances customer engagement, streamlines in-store communication, and reduces aimless browsing duration effectively.

Sirqul, Inc. (2018) Carrefour Taiwan partnered with Sirqul's Edysen IoT solution for smart retail, aiming to enhance customer experience. Edysen devices tracked shopper behavior using Wi-Fi and BTLE signals, enabling real-time insights for alerts, automation, and promotions. The technology provided daily KPIs and insights on store performance through location-aware devices and AI. It captured customer movement, heat maps, paths, and dwell time, aiding anomaly detection and sending alerts for assistance. The solution also included closed-loop temperature monitoring for product quality.

Makhija R (2022) Levi's partnered with Intel for a real-time inventory monitoring project using RFID technology. A plug-and-play device with an RFID antenna is set up in the store, and items are tagged with RFID tags. The antenna scans the sales floor regularly, accurately tracking item availability. Low stock alerts are generated if items are running low, ensuring timely replenishment.

Elizabeth Karpovich (2023) Get Go, a food store chain, utilized IoT technology to enhance the customer experience. By replacing cooler aisle doors with digital smart screens on Microsoft Azure IoT Edge runtime, they revolutionized in-store interactions. The digital screens offered pricing, promotions, and nutritional details, leading to improved consumer experiences and increased sales through smart merchandising.
Elizabeth Karlovac (2023) Ahold Delhaize, a major global food retailer, implemented electronic shelf labels (ESL) in its stores. ESLs enable convenient pricing access and mobile payments. Automated price reductions for products nearing expiry are also facilitated. The ESLs, enhanced with Microsoft capabilities, allow remote updates for over 3 million labels in just 80 minutes.

Elizabeth Karlovac (2023) Control ant, a pharmaceutical supply chain leader, employs 200,000 IoT SIMs in devices across trucks, pallets, and boxes. These devices transmit data to Controlant's platform, enabling real-time alerts and optimized supply routes. Customers utilize this data to ensure safe transport and compliance with healthcare regulations, enhancing delivery efficiency.

Tim Denman and Jamie Grill-Goodman (2017) Target has embraced IoT since 2015, testing beacon technology in 50 locations. Presently, they're expanding beacon and Bluetooth tech in 1,000 stores, enhancing the Target iOS app's wayfinding feature. Shoppers' locations are displayed on the app's map as they move, also highlighting nearby Cartwheel deals. Target's concept store, Open House, was renovated, featuring the Garage space for companies to showcase products and gain real-time feedback through Mission Control, a tool offering insights on guest interactions and sales.
Tim Denman and Jamie Grill-Goodman (2021) Kroger, a leading supermarket chain, is adapting to the changing grocery landscape through tech innovation. It's testing IoT with digital shelf edge technology that employs in-store sensors to provide personalized recommendations and pricing to shoppers via their smartphones and digital displays. By pinpointing shoppers' locations, this IoT solution offers tailored content based on them in-store position.

Challenges:

Dlamini and Johnston's (2016) research suggests that the application of IoT is rapidly increasing in the retail industry and recommends non-users to invest in it in the near future. The study also suggests that retailers must overcome challenges like data privacy, security, and network issues to reap the benefits of IoT in the future. Bujari et al. (2018) study identified that factors such as interoperability, security, privacy, and business models pose limitations on the utilization of IoT. Kaushik and Dahiya (2018) research also warns that IoT technologies are vulnerable to various security and privacy issues. Similarly, Roe et al. (2022) study emphasize that IoT security poses a significant challenge for companies adopting IoT devices as part of their smart store transformation. In a recent study, Har et al. (2022) observed that the adoption of Retail 4.0 is limited in the least

developed countries due to factors such as the high cost of internet, inadequate skilled workforce, and insufficient government initiatives. Their study further suggests that governments of less developed countries should promote digital entrepreneurship and commerce to improve the situation. According to Zunaith (2021) study on the expansion of e-commerce, governments in developing nations should improve their telecommunication infrastructure and regulatory frameworks to encourage local businesses, especially small enterprises, to participate in the digital economy. The study recommends promoting digital entrepreneurship as well to achieve this objective. Maier's (2016) study shows that in order to leverage the advantages of the IoT, businesses need to address security and privacy concerns. The study also concludes that the marketing value of IoT applications is highest in the retail industry compared to other domains. According to Nikola et al. (2016), IoT solutions can provide safety, intelligence, quick decision-making benefits but, they also present challenges in terms of privacy and security. Despite these limitations, the benefits of IoT in the retail industry are significant and are likely to outweigh the challenges in the long term. Retailers are increasingly adopting IoT technology to improve their operations, enhance the customer experience, and increase efficiency.

Summary:

From the above studies it is clearly understood IoT helps retailers for predicting customers' shopping behaviors, acquire valuable information, receive real-time reporting, and conduct continuous monitoring, gaining increased revenue, enhanced operational efficiency, improved channel integration, optimized supply chain management, and an elevated customer shopping experience, inventory management, predictive maintenance, detect potential theft. However, the use of IoT in retail industry also have several challenges like data privacy, security issues like cyber-attacks, hacking customer information, network issues, interoperability, handling large amount of data, cost of maintenance and upgrading information of IoT. in spite of these challenges majority of the retailers are still embracing the potential of IoT to improve efficiency, enhance customer experience a drive growth. Retailers in order to survive in the competitive market should take advantage of IoT. Retailers benefit from IoT in various ways, including obtaining useful information, real-time reporting, and continual monitoring. This may help them improve their clients' experience and increase their earnings. This study aims to provides marketers and retailers an insight advice for the enhanced satisfaction of consumers improving the satisfaction of consumers and the development of smart retail.

Conclusion:

Retailers and government bodies alike should proactively harness the potential of IoT while navigating its challenges for a resilient retail landscape. Retailers must strategically embrace IoT applications that enhance customer experiences, improve operational efficiency, and create value. Sensing, analyzing, and acting upon IoT data through analytics should be a central approach. Ensuring robust data privacy and security measures is paramount to build trust among consumers. Collaboration with technology providers and experts can facilitate seamless implementation and address interoperability concerns. By capitalizing on the convergence of physical and digital realms, retailers can optimize supply chains, enrich customer interactions, and secure a competitive edge. Policymakers need to enhance internet infrastructure, develop regulatory framework for data privacy and security, and encouraging digital entrepreneurship. Future research should focus on the long term impact of IoT, its influence on consumer behavior, cost-benefit analysis, and solutions for interoperability issues. This study offers invaluable insights and guidance for retailers to thrive in the dynamic retail environment by leveraging the transformative potential of IoT, thus fostering growth and innovation while safeguarding consumer interests.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author received no financial support for the research, authorship and/or publication of this article.

References:

Adhicandra, I., Tanwir, T., Asfahani, A., Sitopu, J. W., & Irawan, F. (2024). Latest Innovations in Internet of Things (IoT): Digital Transformation Across Industries. Innovative: Journal Of Social Science Research, 4(3), 1027-1037.

Ahmed, Z. (2021). Understanding the global e-commerce growth: A review. International Journal of Business and Management Invention (IJBMI), 10(11), 50-53. https://doi.org/10.35629/8028

Al-Nabet, N. S. (2021). A case study of the benefits of the IoT in the Qatari retail industry. Studies in Business and Economics, 24(1).

Balaji, M. S., & Roy, S. K. (2017). Value co-creation with Internet of Things technology in the retail industry. Journal of Marketing Management, 33(1-2), 7-31.

Bujari, A., Furini, M., Mandreoli, F., Martoglia, R., Montangero, M., & Ronzani, D. (2018). Standards, security, and business models: Key challenges for the IoT scenario. Mobile Networks and Applications, 23(1), 147-154.

Caro, F., & Sadr, R. (2019). The Internet of Things (IoT) in retail: Bridging supply and demand. Business Horizons, 62(1), 47-54.

Chan, C. O., Lau, H. C. W., & Fan, Y. (2018). IoT data acquisition in fashion retail application: Fuzzy logic approach. In 2018 International Conference on Artificial Intelligence and Big Data (ICAIBD) (pp. 52-56). IEEE. https://doi.org/10.1109/ICAIBD.2018.8396166

Chung, K. C., & Tan, P. J. B. (2024). IoT-powered personalization: creating the optimal shopping experience in digital twin VFRs. Internet of Things, 26, 101216.

Cong, L. W., Li, B., & Zhang, Q. T. (2021). Internet of Things: Business economics and applications. Review of Business, 41(1), 15-29.

Dasgupta, A., Nagaraj, R., & Nagamani, K. (2016). An Internet of Things platform with Google Eddystone beacons. Journal of Software Engineering and Applications, 9(6), 291-295.

De Vass, T., Shee, H., & Miah, S. J. (2018). The effect of "Internet of Things" on supply chain integration and performance: An organizational capability perspective. Australasian Journal of Information Systems, 22.

De Vass, T., Shee, H., & Miah, S. J. (2021). IoT in supply chain management: A narrative on retail sector sustainability. International Journal of Logistics Research and Applications, 24(6), 605-624.

Dlamini, N. N., & Johnston, K. (2016, November). The use, benefits, and challenges of using the Internet of Things (IoT) in retail businesses: A literature review. In 2016 International Conference on Advances in Computing and Communication Engineering (ICACCE) (pp. 430-436). IEEE.

Grill-Goodman, T., & Denman, J. (2021, December 9). 7 retailers using IoT to power their digital transformation. RIS News. Retrieved from https://risnews.com/7-retailers-using-iot-power-their-digital-transformation

Har, L. L., Rashid, U. K., Te Chuan, L., Sen, S. C., & Xia, L. Y. (2022). Revolution of retail industry: From perspective of retail 1.0 to 4.0. Procedia Computer Science, 200, 1615-1625.

Kamble, S. S., Gunasekaran, A., Parekh, H., & Joshi, S. (2019). Modeling the Internet of Things adoption barriers in food retail supply chains. Journal of Retailing and Consumer Services, 48, 154-168.

Karpovich, E. (2023, July 17). IoT in retail: Top 5 use cases and real-life examples. Retail Touchpoints. Retrieved from https://www.retailtouchpoints.com/features/executive-viewpoints/iot-in-retail-top-5-use-cases-and-real-life-examples

Kaushik, K., & Dahiya, S. (2018, November). Security and privacy in IoT-based e-business and retail. In 2018 International Conference on System Modeling & Advancement in Research Trends (SMART) (pp. 78-81). IEEE.

Khan, S. A., Ahmad, S., & Jamshed, M. (2021). IoT-enabled services in online food retailing. Journal of Public Affairs, 21(1), e2150.

Končar, J., Vučenović, S., & Marić, R. (2020). Green supply chain management in retailing based on Internet of Things. In Integration of Information Flow for Greening Supply Chain Management (pp. 181-202). Springer.

Lazaris, C., Vrechopoulos, A., & Doukidis, G. I. (2017). Physical web atmospherics: Utilizing Internet of Things to conceptualize store atmosphere in omnichannel retailing. International Journal of Technology Marketing, 12(4), 389-416.

Maier, M. V. (2016). The Internet of Things (IoT): What is the potential of Internet of Things applications for consumer marketing? [Bachelor's thesis, University of Twente].

Makhija, R. (2022). 6 best examples of IoT in the retail industry. In Artificial Intelligence +. Retrieved August 30, 2023, from https://www.aiplusinfo.com/blog/6-best-examples-of-iot-in-the-retail-industry/

McKinsey & Company. (2021). COVID-19: Implications for business. Retrieved from https://www.mckinsey.com/business-functions/risk-and-resilience/our-insights/covid-19-implications-for-business-2021

McKinsey & Company. (2021). The Internet of Things: Catching up to an accelerating opportunity.

Meenu, E. G. (2021). AR and robots: Redefining retail industry and in-store experiences. Analytics Insight. Retrieved August 23, 2022, from https://www.analyticsinsight.net/ar-and-robots-redefining-retail-industry-and-in-store-experiences/

Mitchell, D. (2022). 5 IoT applications retailers are using today: From RFID to the smart store, retailers are taking advantage of the IoT. SAS. Retrieved August 24, 2022, from https://www.sas.com/en_us/insights/articles/big-data/five-iot-applications-retailers-are-using-today.html

Nielsen IQ. (2022). Trends shaping the global FMCG retail landscape. Retrieved August 24, 2022, from https://nielseniq.com/global/en/insights/analysis/2022/trends-shaping-the-global-fmcg-retail-landscape/

Nukala, R., Panduru, K., Shields, A., Riordan, D., Doody, P., & Walsh, J. (2016, June). Internet of Things: A review from 'farm to fork'. In 2016 27th Irish Signals and Systems Conference (ISSC) (pp. 1-6). IEEE.

Pierko, A. (2021). 6 examples of how data streaming and IoT leverage retail data systems. Netguru. Retrieved August 24, 2022, from https://www.netguru.com/blog/data-streaming-and-iot-in-retail

Raji, M. A., Olodo, H. B., Oke, T. T., Addy, W. A., Ofodile, O. C., & Oyewole, A. T. (2024). Real-time data analytics in retail: A review of USA and global practices. GSC Advanced Research and Reviews, 18(3), 059-065.

Roe, M., Spanaki, K., Ioannou, A., Zamani, E. D., & Giannakis, M. (2022). Drivers and challenges of Internet of Things diffusion in smart stores: A field exploration. Technological Forecasting and Social Change, 178, 121593.

Sirqul, Inc. (2023). Crafting Carrefour's new in-store retail experiences. Retrieved August 30, 2023, from https://corp.sirqul.com/IoT-solutions/Carrefour/

Shin, S., & Eksioglu, B. (2014). Effects of RFID technology on efficiency and profitability in retail supply chains. Journal of Applied Business Research (JABR), 30(3), 633-646.

Sukhani, K., Qomariyah, N. N., & Purwita, A. A. (2022). CleverCart: An eco-friendly shopping self-checkout system with IoT sensor. In 5th International Conference on Earth and Environmental Science, 998, IOP Publishing.

Vučenović, S. (2018). Internet of Things as innovative technology in retailing. Anali Ekonomskog fakulteta u Subotici, 39, 249-256.