# The Transformative Role of AI and Machine Learning in Retail: Enhancing Consumer Experience and Engagement - A Case Study of Morrisons

Qingze Wang*

The University of Liverpool, Liverpool, United Kingdom

*Corresponding author: sgqwan13@liverpool.ac.uk

**Abstract.** The retail industry is undergoing significant changes driven by technological advancements in Artificial Intelligence (AI) and Machine Learning (ML). Traditional retailers are faced with the challenge of adapting to these technologies, hence new entrants who leverage from these technologies gain competitive advantage over them, the report focuses on the case of Morrisons, a UK based supermarket chain which began as a traditional supermarket and implemented these technologies recently with the aim to enhance customer experience and operational efficiency. Morrisons has embraced AI and ML to optimize stock levels, predict demand, and improve customer service. The partnership with tech firm Blue Yonder resulted in a system that accurately predicts store-specific markets by analysing sales data and weather patterns. As a result, Morrisons achieved a 30% reduction in shelf gaps, significantly enhancing the overall shopping experience. The study analyses how Morrisons implemented AI and ML technologies in their retail operations, types of technologies adopted and their practical applications. The methodology uses a qualitative case study approach, utilising document analysis of Morrisons corporate publications, industry reports and primary data from surveys. The research highlights Morrisons strategic implementation of AI-driven systems through partnerships with leading technological companies leveraging data. also addresses the challenges faced during this digital transformation, such as staff adaption and data privacy concerns, proposing a balanced approach to the retail landscape. The findings indicate that AI and ML technologies offer a competitive advantage, but each year, they are becoming essential for survival and growth in the retail sector. Morrisons case provides critical insights into the future of the retail market through technological innovation, ethical considerations, and an improved focus on the customer shopping experience.

**Keywords:** Retail Industry; Artificial Intelligence (AI); Machine Learning (ML); Morrisons; Customer Experience.

## 1. Introduction

Retail Businesses that use traditional models face new challenges from new companies that can deliver better value to customers by leveraging data [1]. One of the main challenges within the retail industry is the length of the value chain and how inefficient it is for businesses, especially in terms of costs. However, new entrants in the sector are leveraging new technologies that allow manufacturers and third parties to engage directly with the customer, catering to their needs, increasing their satisfaction and gaining a competitive edge over traditional retailers [2].

For retailers to survive, they must adapt to newer technologies that leverage data, making the whole business process more efficient and constantly innovating their value chain to adapt to the ever-changing, diversified customer market [2]. Retailers who have achieved this competitive advantage have leveraged data to be used in Artificial Intelligence (AI) and Machine Learning (ML) to enhance the company's customer experience and operational efficiency. This has projected that AI services in the sector will go from $5 billion to over $31 billion by 2028, further emphasizing the obligation to incorporate these technologies to survive in the market [3].

For this report, Morrisons, a supermarket chain based in the United Kingdom, is used as a case study, as they have been an excellent example of going from traditional retail to being innovative. Morrisons adoption of AI and ML shows how these technologies can be used to gain competitive advantage in the retail industry. This was implemented thanks to its partnership with Blue Yonder,

where the systems optimise stock levels in its 491 stores [4]. The system uses historical sales data and weather patterns to understand customer shopping in the past, then uses that to forecast future demand, which helps control the store's supply of products. AI is not only used to optimise stock levels but also implemented to improve customer experience and operational efficiency, for which the supermarket has seen a 30% reduction in shelf gaps [4]. After stating the importance of implementing AI and ML technologies in retail, the report aims to analyse Morrisons implementation strategy and evaluate its effectiveness in improving operational efficiency and enhancing customer experience. By exploring this case, the report will provide insights into the implications of implementing AI and ML into the retail sector and its future.

### 1.1. Background

AI and ML are the core elements of Industry 4.0, which has been around since 2010 and is funded by national governments and big industries [5]. The importance of these technologies and what led industries to implement them began when IBM developed Deep Blue, which beat chess world champion Garry Kasparov in 1997 [6]. Since then, AI development has been a critical factor in the past 20 years, followed by increased computational power to perform tasks that the human brain can do at higher speeds and lower costs. Nowadays, tech giants such as Amazon, eBay and Apple have integrated AI and ML into their operations to automate simple tasks and use massive amounts of data to extract profitable meanings [7]. G. Cao noted six management areas where AI can provide a competitive advantage in the retail sector [8].

In retail management, leveraging technology is crucial for staying ahead in the competitive market. One key aspect is data management, where processing real-time data analysis, integrated with machine learning, is essential for predicting product demand. This requires establishing partnerships with digital technology providers to enhance capabilities. For customer service management, it's vital to streamline the shopping experience. This includes implementing features like image or voice search, recommendation algorithms, and faster checkout processes designed to cater to customer needs efficiently.

Store management also benefits from these systems, as they utilise data to track stock levels and display product availability in real-time, which helps contact the suppliers for more products. In the past, retailers had difficulties handling repetitive or large orders, resulting in longer times to process orders, hence low product availability; this has become much easier as AI can automatically order from suppliers if the product is out of stock or forecasts that the product demand will increase at a specific date or season of the year, streamlining the overall process. Another aspect of AI's ability is to control inventory management efficiently; as discussed, AI can automatically order products when stock is low, but ordering too much can become costlier if it does not sell due to additional inventory costs, so ordering the correct amount is essential. In marketing management, demand forecasting is also used to adjust prices based on real-time supply and demand, making the immediate analysis of data based on factors such as date, time, or weather critical to promote products efficiently. The amount of data that goes through retail servers is enormous, especially the amount of personal data stored from customers, and requires strong cybersecurity and risk management systems to ensure protection and improve loyalty. This is where AI-powered real-time defense systems become indispensable. These systems protect customer data stored in retailers' cloud databases constantly, thus safeguarding the company's reputation and ensuring customer trust.

Whilst several companies have claimed that implementing these technologies was beneficial for their operations, 41% of retailers still need to be made aware of the benefits of AI despite the shift in the retail industry towards big data and intelligent supply chains [9].

However, Morrisons, a traditional retailer founded in 1899, has continuously evolved to meet the changing demands in the past 100 years to stay in the competition. In 1958, the company opened its first self-service store with product pricing and checkouts, setting new standards in customer convenience and retail innovation [10].

In 2013, the company partnered with Ocado to leverage its technology to begin with online food delivery services [11], signalling its entry into the digital retail space. Furthermore, their partnership with Amazon in 2016 allowed Morrisons to extend their customer base, offering a wide range of products through Amazon's fresh platform [4].

### 1.2. Research Questions

#### 1.2.1. How has Morrisons implemented AI and ML technologies in their retail operations?

The question looks at how Morrisons decided to integrate AI and ML technologies into their retail company. It looks into the type of AI they have decided to use, the reasoning behind such investment, and the operations into which these are implemented. This question will help traditional retailers understand the benefits of these systems in retail, and what can appear to be a costly investment can turn into a sizeable competitive edge in the long term.

#### 1.2.2. What impact have AI and ML technologies had on Morrisons' operational efficiency and customer experience?

The second question seeks to analyse the effects of AI and ML in Morrisons and if AI has assisted in solving or improving their issues and inefficiencies at the time. The focus will be mainly on managing stock, predicting what products will be needed and streaming the overall supply chain. The second part will look at whether these systems have improved the overall shopping experience for customers. Improving operational efficiency is advantageous to the retailer; however, looking at how it affects customers by using secondary data on what they consider essential when shopping is another crucial aspect of the business, as well as deciding where it is worth implementing these systems.

## 2. Methods

### 2.1. Document Analysis

The study uses a qualitative analysis of the implementation and impacts of AI and ML technologies at Morrisons to provide an understanding of how they implement these technologies and their effects on operational efficiency and customer shopping experience.

The study's data collection focuses on Morrisons' own corporate publications, deemed primary sources for this research. These include the company's quarterly and annual reports, which shed light on Morrisons' financial health and strategic directions, particularly concerning AI and ML technologies [12]. The financial statements within these reports offer quantitative data that can be analysed in relation to the implementation phases of AI and ML. Additionally, Morrisons' press releases are pivotal, as they provide insight into the company's public declarations about technological advancements and strategies. These documents are invaluable for the study as they present a detailed account of Morrisons' strategies for adopting and implementing AI and ML technologies, their self-assessment of these initiatives, and the financial performance connected to these technological advancements.

The study also uses secondary sources to enhance its analysis and provide an outside view. Academic journals are important as they offer theories and context about AI and ML in retail. Reports from the industry give a wider view of the market and help compare Morrisons with other companies. News articles are useful for current information on how people see Morrisons' tech moves and their effect on the retail world.

The main method of analysis in this study is thematic content analysis. This means looking closely at all the collected data to find common themes or patterns. The focus is on digging deep into how AI and ML are talked about and shown in the data [13]. Finally, the study neatly lays out its findings, emphasizing how using AI and ML has changed how Morrisons does business, affected customer satisfaction, and the challenges and opportunities that have come up.

The analysis pays attention to details like what types of AI and ML technologies Morrisons chose, how they are used in the store's day-to-day activities, and their impact on the company's success. This

careful approach gives a complete picture of how Morrisons has been working with these advanced technologies. It reveals the good points, the challenges, and the overall effect on the retail world.

By using this method, the study tells a detailed story of how Morrisons has been adopting AI and ML. It gives a clear view of the strategic choices they made, the changes in how they operate, and the outcomes in terms of efficiency, customer experience, and how they stand compared to other retailers.

### 2.2. Case study: Implementation of Artificial Intelligence and Machine Learning

In 2018, Morrisons partnered with Blue Yonder to implement the Demand Forecast and Replenishment Solution, led by inefficiencies in inventory, on-shelf availability, and reducing checkout queues, aiming to improve customer experience by having products available most of the time [4]. This began a trial a year before the complete implementation to test the system and its efficiency. However, the retailer tackled key challenges in inventory management, particularly in balancing understocking and overstocking issues [14].

Implementing this AI solution enabled Morrisons to optimise replenishment across a wide range of stock-keeping units (SKUs), resulting in a 30% reduction in shelf gaps. After this improvement in the trials, they decided to implement the system entirely in 2018, as this was not only an improvement in ambient and long-life product categories but also extended to fresh and produce items, covering 29,000 SKUs. The system also has self-adjusting capabilities and a cloud-based nature, allowing for rapid processing that responds to customer demands. For example, it can perform 430 million calculations and 13 million automatic decisions daily [4]. During the AI trial phase, the system demonstrated its potential by improving sales, especially during peak seasons, as it can predict trading patterns using ML. This allows for efficient product allocation and time-saving to know approximately the staff required in each season, enhancing overall efficiency and staff productivity [2].

Store managers might have been sceptical of new IT systems. However, the benefits lead to the demand for new implementations not only in the store but also in the supply chain and other product groups, excluding fashion products. The Blue Yonder case study showcases retailers' ability to transform their operations, from automating resource-intensive tasks to delivering demand forecasting using historical data, thereby enhancing customer and operational efficiency.

However, the transition to this AI-driven system had plenty of challenges. A significant one was ensuring the smooth adaption of staff to the new technology [1]. Morrisons tackled this by focusing on training programs and change management strategies to aid their staff in understanding and effectively utilising the new systems. As a result, the technology not only made the chain more operationally efficient but also fed up staff time by reducing the amount of repetitive tasks, allowing them to focus more on improving customer experience.

### 2.3. Enhancing Customer Loyalty and Satisfaction at Morrisons

A survey made by Oracle 2022 examines customer shopper behaviour and highlights the most important factors that attract customers to keep shopping and stay loyal to the brand. The effect of COVID-19 pushed most people to shop online; according to the survey, 53% of respondents in the US said they started purchasing groceries online during the pandemic, while 93% of online shoppers expected to continue shopping online after the pandemic [15].

In the second survey, called the Oracle Accenture grocery consumer survey, people were asked what are the important factors when shopping for groceries; more than 90% of respondents said that they would choose a brand based on product availability, proximity to home and the availability to shop as quickly as possible. Low prices and promotions were the third and fourth most popular answers. However, they expect food freshness and quality to be a standard or a must [16].

Considering these choices, Morrisons has tackled most of these to achieve customer satisfaction. Online shopping using a membership or an account stores data from each customer for personalized marketing and promotions, ensuring that the products are available for each customer, as Blue Yonder's helped reduce 30% shelf gaps [4]. Additionally, based on the demand, Morrisons reduces

their products' prices and promotes them to their members based on the ML system that predicts product seasonality [17].

Fast checkouts were a challenge in stores until they implemented self-checkouts to reduce waiting times in in-store shopping. However, at the beginning of 2010, when ordering online, the order had to be processed by a human, which took additional time and could have been more efficient, pushing customers to store in shops instead. This changed when AI and ML were implemented in their online stores, as order processing became much faster. When an order is sent to Morrisons, AI analyses the product code and quantity required and analyses the product's stock availability at the slot selected. ML system will send an order to the supplier immediately to restock the shops, ensuring every single product is fresh and available for that day; this is defined as a sales-based ordering system. Another option they implemented is the 'Click and Collect' service, where the customer checks out on the website, the data is sent immediately to the store, and the employee prepares the products for the customer to collect in less than an hour, making the shopping experience much more efficient in and out of the store [18].

One of the biggest challenges Morrisons faced was their consistency with store replenishment due to the manual ordering of products, which took 2-3 days. So, the plan was to make every product available in each of the 491 stores to meet customer demands in the shortest time possible. By integrating these technologies, they can offer their customers a more personalised and efficient shopping journey by tackling understocking and overstocking [4].

The system is predicted to be much more efficient each year, not only because AI is improving in performing repetitive and more complicated tasks much faster than humans but also because the data stored each year helps build predictive models with machine learning [3]. This uses historical data to predict demand forecasting, customer buying behaviour, price optimisation, disruptions in the supply chain, sale trends and product recommendations. By implementing personalised marketing catered to each customer, they understand their behaviour and what to advertise for them, improving the overall shopping experience [2].

Furthermore, the system is personalised to every single store in the UK, forecasting different demand and supply data based on the performance of each [4]. This prevents the generalisation of the results, as the weather and other variables across the UK are different from other locations; for example, Scotland's weather gets colder than London, which could affect the shopping experience and product demand in each of the stores located in those zones, ensuring that customers have access to their desired product no matter where they are. In the same Oracle survey, more than 40% of respondents said that the availability and variety of products make them more loyal to a grocery store. AI has shown its usefulness in tackling this challenge [15].

Customers reported enjoying Morrisons experience because there are notable improvements each year, especially in their fast checkouts, price offers and promotions on their products [19]. One of the ways they achieved this is by using demand forecasting on kids' favourite meals and offering family meal promotions. This is done by combining meals that adults and kids enjoy, enhancing their satisfaction and improving sales at Morrisons.

### 2.4. Consumer Interaction with AI in the Retail Industry

Morrisons AI implementation was focused on improving store operations and efficiency, indirectly affecting customer experience. For instance, Morrisons ensures product availability by using AI to optimise stock levels. However, AI and improvements in retail are expected to improve and rise by 2035 [2].

An example of consumer direct interaction with AI is Carrefour, a French multinational retail and wholesale corporation that has leveraged OpenAI's GPT-4 technology to develop an AI-powered shopping assistant chatbot, Hopla. The direct interaction between the customer and the chatbot signifies a shift in consumer interaction, thanks to the AI-assisted experience. Customers can chat with Hopla to enhance their shopping experience and obtain customised recommendations based on their shopping budget, dietary preferences and meal ideas [20]. Additionally, it assists with anti-waste

solutions, recipe suggestions, and dietary requirements based on the customers' goals, providing a unique and customised experience for each customer.

Moreover, Carrefour's use of AI enriches product descriptions for over 2,000 products. This feature allows consumers to obtain more detailed information about products, aiding in informed purchasing decisions, increasing consumers' expectations and providing a unique and catered experience [20]. However, the technology was implemented in February 2023, and it was premature. Additionally, the new AI technology requires personal data processing, which raises complex challenges surrounding consent, data ownership, and potential misuse [21].

## 3. Conclusion

In conclusion, this study has analysed the implementation of AI and ML technologies in the retail sector to enhance consumer satisfaction and operational efficiency. Morrison has shown how a traditional retailer can leverage these technologies to improve the business overall and gain a competitive edge in the market. Regarding the first objective, the study found that AI systems interact indirectly with customers, meaning that by improving operational efficiency and significantly reducing shelf gaps, which AI automates, Morrison already tackled customers' priorities when shopping in retail, according to Oracle's survey. Additionally, by automating repetitive tasks, the industry can divert its staff focus on improving customer service.

The second objective, as stated, is that AI does not interact directly with customers. However, retailers such as Carrefour have implemented chatbots. These chatbots interact directly with consumers, providing each customer with an enhanced and unique shopping experience. However, it functions using personal data, raising privacy concerns. As suggested by Morrisons experience, the future of retail will likely be characterised by a greater reliance on AI and ML. However, this transition is challenging, particularly in adapting staff to new technologies and addressing data privacy concerns. As the retail sector continues to evolve, a balanced approach combining technological innovation with ethical considerations and enhancing customer experience will be essential for success.

## References

[1] Deloitte, Disruptions in Retail through Digital Transformation Reimagining the Store of the Future. Online, 2017, Available: from https://www2.deloitte.com/content/dam/Deloitte/in/Documents/CIP/in-cip-disruptions-in-retail-noexp.pdf.

[2] Deloitte, "The New Retail Operating Model of the Future: How retailers need to adapt their operating model to become future-ready." Online, 2020, Available: from https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-business/Study_Retail%20Operating%20Model%20of%20the%20Future.pdf.

[3] W. Yili, "Here's how artificial intelligence can benefit the retail sector," World Economic Forum.Online,2023, Available: https://www.weforum.org/agenda/2023/01/here-s-how-artificial-intelligence-benefit-retail-sector-davos2023/.

[4] Blue Yonder, "Store Replenishment at Morrisons: How Morrisons adopted AI technology to deliver on its promise to customers and transform store replenishment." Online, 2018, Available: https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE3oAKl.

[5] Har, L. L., Rashid, U. K., Chuan, L. T., Sen, S. C., & Xia, L. Y. Revolution of Retail Industry: From Perspective of Retail 1.0 to 4.0. Procedia Computer Science, 200(1), 1615-1625, 2022, doi: https://doi.org/10.1016/j.procs.2022.01.362.

[6] IBM. What is artificial intelligence (AI)? IBM. Online, 2023, Available: https://www.ibm.com/topics/artificial-intelligence.

[7] McKinsey Global Institute. What's now and next in analytics, AI, and automation. McKinsey & Company. Online, 2017, Available: https://www.mckinsey.com/featured-insights/digital-disruption/whats-now-and-next-in-analytics-ai-and-automation.

[8] Cao, G., Duan, Y., Edwards, J. S., & Dwivedi, Y. K. Understanding managers' attitudes and behavioral intentions towards using artificial intelligence for organizational decision-making. Technovation, 106, 102312., 2021, doi: https://doi.org/10.1016/j.technovation.2021.102312.

[9] Bughin, J. et al. Artificial Intelligence: The Next Digital Frontier? McKinsey & Company. Online, 2017, Available :https://www.mckinsey.com/~/media/McKinsey/Industries/Advanced%20Electronics/Our%20Insights/How%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/MGI-Artificial-Intelligence-Discussion-paper.ashx.

[10] Yates-Roberts, E. Morrisons implements Blue Yonder's AI stock replenishment technology. Technology Record. Online, 2018, Available: https://www.technologyrecord.com/article/morrisons-implements-blue-yonders-ai-stock-replenishment-technology.

[11] Ocado Group. Morrisons. Online, 2013, Available: https://www.ocadogroup.com/about-us/osp-partners/morrisons/.

[12] OECD. Artificial Intelligence, Machine Learning and Big Data in Finance: Opportunities, Challenges and Implications for Policy Makers. Online, 2021, Avliable: https://www.oecd.org/finance/financial-markets/Artificial-intelligence-machine-learning-big-data-in-finance.pdf.

[13] Vaismoradi, M., Turunen, H., & Bondas, T. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. Nursing & Health Sciences, 15(3), 398-405, 2013, doi: https://doi.org/10.1111/nhs.12048.

[14] Blue Yonder. Morrisons Puts the Customer at the Heart of Every Decision. Online, 2019, Available: https://blueyonder.com/knowledge-center/collateral/morrisons-case-study.

[15] Tsidulko, J. Top 10 Grocery Consumer Expectations. Oracle.com. Online, 2023, Available: https://www.oracle.com/uk/retail/grocery-customer-expectations/.

[16] Accenture. Reimagining the grocery experience for UK consumers. Accenture.com. Onlien, 2021, Available: https://www.accenture.com/gb-en/insights/retail/grocery-experience.

[17] Alam, S., Andrew, M., Jesse'o'hanley, & Wu, S. Optimising supermarket promotions of fast-moving consumer goods using disaggregated sales data: A case study of Tesco and their small and medium-sized suppliers. Online, 2015, Available: https://core.ac.uk/download/pdf/30712619.pdf.

[18] Stevens, B. Morrisons latest to launch AI-powered checkout-free store system. Charged Retail. Online, 2021, Available: https://www.chargedretail.co.uk/2021/07/19/morrisons-latest-to-launch-ai-powered-checkout-free-store-system/.

[19] Morrisons PLC. Company History - Morrisons Corporate. Online, 2023, Available: https://www.morrisons-corporate.com/about-us/company-history/.

[20] Carrefour. Carrefour integrates OpenAI technologies and launches a generative AI-powered shopping experience. Carrefour Group. Online, 2023, Available: https://www.carrefour.com/en/news/2023/carrefour-integrates-openai-technologies-and-launches-generative-ai-powered-shopping.

[21] Van Rijmenam, M. Privacy in the Age of AI: Risks, Challenges and Solutions. Dr. Mark van Rijmenam, CSP - The Digital Speaker. Online, 2023, Available: https://www.thedigitalspeaker.com/privacy-age-ai-risks-challenges-solutions/.