

THE ROLE OF TECHNOLOGICAL INNOVATION IN MERCHANDISING

Mariana Stoica¹

Abstract. This academic paper aims to explore the role of technological innovation in merchandising and its impact on consumer behaviour and retail performance. The study uses a systematic review and meta-analysis approach to collect and analyse existing research articles, industry reports and case studies related to technological innovation in merchandising. A comprehensive search strategy is used to identify relevant literature sources and rigorous inclusion and exclusion criteria are applied to select high quality studies for analysis. The results of the systematic review and meta-analysis demonstrate the significant impact of technological innovation on various aspects of merchandising. These include improvements in inventory management, supply chain logistics, product presentation and customer engagement. In addition, the integration of technology into merchandising strategies was found to enhance the customer experience, increase sales conversion and improve overall retail performance. The findings of this study have practical implications for retailers and marketers seeking to leverage technological innovation in their merchandising strategies. It highlights the importance of embracing emerging technologies such as augmented reality, virtual reality, mobile applications and smart devices to create immersive and interactive shopping experiences. Retailers can use these technologies to improve product discovery, provide personalised recommendations and streamline the buying process. In addition, the study highlights the need for continuous adaptation and investment in technology to remain competitive in the evolving retail landscape. This research contributes to the existing body of knowledge by systematically synthesising the available evidence on the role of technological innovation in merchandising. It provides valuable insights into the potential benefits and challenges associated with the adoption of new technologies in the retail sector. This study serves as a valuable resource for academics, practitioners and policy makers interested in understanding and harnessing the power of technological innovation in merchandising.

Key words: technological innovations, merchandising, consumer behaviour, supply chain logistics, augmented reality, retail, competitive advantages.

JEL Classification: L81

1. Introduction

Technological innovation has become a major driver of change in the retail industry, changing the way consumers shop and impacting retail performance. In this article, the author aims to explore the role of technological innovations in merchandising and their impact on consumer behaviour and retail performance.

To achieve this goal, a systematic review and meta-analysis approach will be used to collect and analyse existing research articles, industry reports and case studies related to technological innovation in merchandising. By synthesising

and critically evaluating the available data, valuable insights can be gained into the potential benefits and challenges associated with the introduction of new technologies in the retail sector.

A comprehensive search strategy is used to identify relevant literature sources, ensuring that a wide range of perspectives and studies are included in the analysis. Rigorous inclusion and exclusion criteria are used to select high quality studies for analysis, which increases the reliability and validity of the findings.

The results of the systematic review and meta-analysis demonstrate the significant impact of

¹ Moldova State University, Republic of Moldova (*corresponding author*)
E-mail: stoicamarianamd@gmail.com
ORCID: <https://orcid.org/0000-0002-1624-7353>



technological innovation on various aspects of merchandising. In particular, it was found that integrating technology into merchandising strategies improves the customer experience, increases sales conversion and improves the overall performance of retailers. This is achieved through improvements in inventory management, supply chain logistics, product presentation and customer engagement.

Additionally, this analysis highlights the importance of embracing emerging technologies such as augmented reality, virtual reality, mobile applications and smart devices to create immersive and interactive shopping experiences. Retailers can use these technologies to enhance product discovery, provide personalised recommendations and streamline the purchase process. However, the paper also addresses the challenges and considerations associated with incorporating technological innovation into merchandising strategies. These include issues related to infrastructure, training and customer acceptance. The findings underscore the need for continuous adaptation and investment in technology to remain competitive in the evolving retail landscape.

By systematically summarising the available evidence on the role of technological innovation in merchandising, this study contributes to the existing body of knowledge. The practical implications of this study are important for retailers and marketers who want to use technological innovation in their merchandising strategies. The results of the study provide guidance on potential benefits and challenges, emphasising the importance of technological integration for retail efficiency and competitive advantage. By examining the impact of technology on consumer behaviour and retail performance, the author offers important insights that can help inform decision-making and strategy development in the retail sector.

2. Literature Review

The literature review highlights the significant impact of all technological innovations used in the retail industry. For example, there is a large amount of research on augmented reality and virtual reality for the retail industry in the person of research such as Alcaniz M., Bigné E., Guixeres J. (2019), Jengchung V. Chen, Quang-An Ha, Minh Tam Vu (2022), but also Porter M.,

Heppelmann J. (2017) and others. Studies on mobile applications have been conducted by researchers such as Johar M. G. and Awalluddin J. A. A. (2011), Li M., Dong Z. Y. and Chen X. (2013), Arpita Khare and Subhro Sarkar (2020) and others. Investigations on the effects of the use of smart mirrors were carried out by Ogunjimi A., Rahman M., Islam N. and Hasan R. (2021), but also by Alanazi T. M. and Alenazi S. A. (2023). The impact of interactive kiosks on retail has been studied by Barran B., Betzing J. H., Niemann M. (2020), but also by Blázquez M. (2016). Research on radio frequency identification technology used in retail has been conducted by Bose I., Lam C. W. (2008), also Afsharian S. P., Alizadeh A., Chehrehpak M. (2016) and others. Papers on the impact of artificial intelligence on retail have been published by the following researchers: Kaur V., Khullar V., Verma N. (2020), Jayakrishnan S. (2022) and many others.

3. Technological Innovations in Merchandising

There are several major technological innovations used in merchandising that have had a significant impact on the retail industry. The following are some of them:

1. Augmented reality (AR) and virtual reality (VR).
2. Mobile applications.
3. Smart mirrors.
4. Interactive kiosks.
5. Radio-frequency identification (RFID).
6. Artificial intelligence (AI) and machine learning (ML).

Augmented Reality (AR) is a technology that overlays digital elements, such as images, videos or information, on the real world. It combines computer-generated sensory data with the user's real environment, enhancing the user's perception and interaction with the environment. On the other hand, VR is a technology that creates a simulated environment, typically using a head-mounted display or VR goggles, that immerses the user in a digital world. VR aims to replicate an artificial reality that can be interacted with and explored, giving the user a sense of presence and immersion.

Augmented reality (AR) and virtual reality (VR) are having a significant impact on merchandising, transforming the way retailers interact with customers and improving the overall shopping experience. Here are some of the ways AR and VR are impacting merchandising:

– AR and VR allow customers to visualise products in a realistic and immersive way. With AR, customers can overlay virtual images of products onto their real-world environment, allowing them to see how items will look and fit before making a purchase. VR takes this a step further by creating fully virtual environments where customers can explore and interact with products. In both cases, AR and VR enhance product visualisation, reducing uncertainty and increasing confidence in purchase decisions.

– Augmented and virtual reality technologies allow customers to virtually try on products such as clothing, accessories and cosmetics. These technologies recreate the experience of trying on products in a store without the need for physical interaction. Customers can see how clothes fit, experiment with different styles and colours, and virtually customise products. Virtual try-on and customisation features in AR and VR contribute to a personalised shopping experience and increase customer satisfaction.

– AR and VR provide opportunities for interactive product demonstrations, allowing customers to interact with products virtually. For example, AR and VR can overlay training videos or product information on real-world objects to enhance customers' understanding of product features and use. Virtual reality can simulate the experience of using a product, such as test-driving a car or exploring a hotel room, providing customers with a more immersive and engaging way to evaluate a product.

– AR and VR technologies enable retailers to create virtual showrooms and retail spaces. Customers can explore these virtual environments from the comfort of their own homes using VR headsets or mobile devices. Virtual showrooms offer an interactive and immersive shopping experience, with the ability to browse products, view detailed information and make purchases within the virtual space. This increases convenience, extends the reach of retailers and enables experiential shopping without the physical constraints.

– AR and VR significantly increase customer engagement in merchandising. By providing unique and interactive experiences, these technologies capture customer attention and create a memorable connection with brands. AR and VR experiences generate excitement, encourage social media sharing, and increase

brand awareness and loyalty. Retailers can leverage this increased engagement to attract and retain customers, foster strong relationships and drive repeat sales.

In general, augmented and virtual reality technologies have revolutionised merchandising by providing interactive and immersive experiences. They improve product visualisation, facilitate virtual try-on and customisation, enable interactive demonstrations, create virtual showrooms and increase customer engagement. By incorporating augmented and virtual reality into their merchandising strategies, retailers can differentiate themselves, increase customer satisfaction and ultimately increase sales.

Table 1 below shows some successful examples of AR and VR technologies in retail.

Mobile apps are widely used in merchandising to improve the shopping experience and engage customers. Below are some of the ways in which they are being used in the merchandising industry:

– Retailers are developing mobile apps that allow customers to browse and purchase products directly from their smartphones or tablets. These apps offer a user-friendly interface that allows customers to browse product catalogues, read reviews, compare prices and make secure transactions.

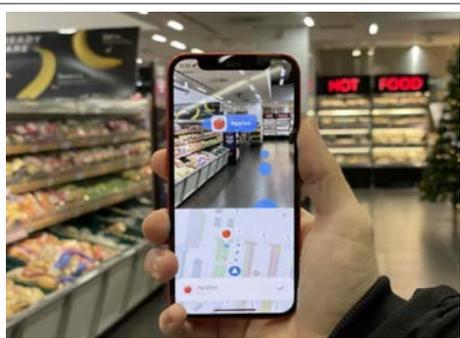
– Mobile apps use user data and algorithms to provide personalised product recommendations. By analysing a user's browsing and purchase history and preferences, mobile apps can offer relevant and tailored product options to improve the shopping experience and increase sales.

– Some retailers are using mobile in-store navigation apps to help customers navigate their way around the store. These apps can use beacon or GPS technology to guide customers through the store, helping them find specific products or departments, and provide real-time offers and promotions based on their location.

– Mobile apps make it easier to implement loyalty programmes by allowing customers to accumulate points, receive exclusive discounts and track their purchase history. These apps help build customer loyalty, encourage repeat purchases and provide a personalised and rewarding experience.

– With mobile applications, retailers can offer a variety of payment options, including digital wallets and mobile payment solutions. Customers can securely complete transactions using their

Table 1
Examples of AR and VR use in retail

Economic agent/ description of AR/VR usage	Sample
<p>IKEA Kreativ / customers can use advanced technology to create a complete 3D replica of their room. The process involves scanning the room using LiDAR technology, which is integrated into the iPhone. Once the scan is complete, customers can easily remove existing furniture and explore new products.</p>	
<p>TOYOTA / has developed AR, which allows customers to easily recognise their car using a camera system and add computer-generated accessories without the need to apply markers or images to the car. This solution provides a more immersive and convenient shopping experience for car accessory shoppers.</p>	
<p>MARKS & SPENCER / customers can enter a list of products they want to buy and then follow an on-screen route to find them on the shelves. When the user lifts the smartphone, the app uses augmented reality technology to display markers and indicate the exact location of the product on the shelf. When the phone is held down, a compass appears on the screen, indicating the direction in which the user should walk to reach the desired product.</p>	
<p>Tommy Hilfiger / using Samsung's GearVR headset, customers can watch a 360-degree, three-dimensional version of the runway as if they were sitting in the front row.</p>	

smartphones, eliminating the need for physical credit cards or cash.

– Mobile apps with augmented reality (AR) capabilities allow customers to virtually try on products such as clothing, glasses or cosmetics before making a purchase. This technology overlays a digital image of the product with

a live image captured by the phone's camera, providing customers with a realistic and interactive shopping experience.

Hence, mobile apps play a crucial role in merchandising, providing a seamless and personalised shopping experience, increasing customer engagement and driving sales for retailers.

Examples of mobile applications that are successfully used in retail



A smart mirror, also known as a magic mirror or interactive mirror, is a technologically advanced mirror that incorporates interactive features and digital display capabilities. Unlike a traditional mirror, a smart mirror is equipped with various technologies such as a screen, sensors, cameras, and software to provide additional functionality and enhance the user experience.

One of the main uses of smart mirrors is to facilitate virtual try-on experiences. Customers can see how different items of clothing, accessories or cosmetics would look on them without physically trying them on. Using augmented reality (AR) technology, smart mirrors overlay digital representations of products onto the customer's reflection, allowing them to visualise different options and make informed purchasing decisions.

Smart mirrors can provide styling and outfit recommendations based on products available in-store or online. By analysing customer preferences, body type and current trends, smart mirrors can suggest complementary items, accessories or complete looks to help customers create cohesive and fashionable outfits.

Smart mirrors can also display product information, pricing details and customer reviews directly on the mirror interface. This allows customers to access comprehensive details about the products they are interested in, giving them a better understanding of the features, benefits and potential drawbacks. This information enables customers to make informed purchasing decisions. It can provide personalised experiences by recognising individual customers and adapting the content displayed accordingly. By integrating customer data and preferences, smart mirrors can provide tailored recommendations,

sizing information or customisation options, allowing customers to create personalised products or select the most suitable options.

With built-in camera capabilities, smart mirrors allow customers to take photos or videos of themselves wearing different outfits or trying on different products. Customers can then share these images or videos on social media platforms, getting feedback from friends or followers and creating user-generated content. This social sharing feature increases customer engagement and creates buzz around the brand or product. Smart mirrors can also collect data and provide retailers with valuable insights. By capturing information such as customer interactions, preferences and buying patterns, retailers can gain a deeper understanding of their customers' behaviours and preferences. This data can be used to improve marketing strategies, personalise offers and optimise the overall shopping experience.

Smart mirrors offer an innovative and interactive way to engage customers, provide personalised recommendations and simplify decision-making in merchandising.

Interactive kiosks are self-service stations located in physical stores that allow customers to browse products, access detailed product information and make purchases.

There are various functions that interactive kiosks can perform, for example:

- They serve as digital product catalogues, providing customers with comprehensive information about available products, including descriptions, specifications, prices and related accessories. Customers can browse through them at the kiosk to familiarise themselves with different product options and make a more informed purchase decision.

Examples of smart mirrors



- Enabling self-service at the checkout, allowing customers to scan and pay for their purchases on their own. These kiosks often accept multiple payment methods, simplifying the checkout process, reducing wait times and providing a convenient and efficient customer experience.
- Simplify ordering for out-of-stock items or items that are available exclusively online. Customers can place their orders at the kiosk, choose delivery methods and make payments. In addition, some retailers have integrated kiosks with in-store inventory management systems, allowing customers to check product availability and reserve items for later pickup.
- Enabling customers to register for loyalty programmes, enter their information and immediately receive rewards or discounts. Customers can also use the kiosks to redeem their loyalty programme rewards, such as coupons or points, for discounts or free goods.
- Equipped with digital displays, they can showcase promotions, advertisements or personalised offers based on customer preferences. These digital signage options help retailers attract

attention, deliver targeted marketing messages and drive sales.

- Collect customer feedback and conduct surveys. Customers can express their opinions, preferences, or suggest improvements, helping retailers gather valuable information to improve their products or services.
- Serve as a navigation function by providing store maps, directions and information about the location of specific departments or products in the store. This feature helps shoppers quickly find the products they are looking for, improving their overall shopping experience.

Interactive kiosks offer convenience, efficiency and a personalised experience for customers, as well as providing retailers with the opportunity to engage with customers, reduce operational costs and collect valuable data. They are becoming increasingly popular in a variety of retail locations, including shopping centres, department stores, supermarkets and speciality boutiques.

There are many examples of interactive kiosks being used in different areas of retail. Some of them are summarised in Table 2.

Table 2

Best kiosks examples

Companies that use kiosks	Samples
<p>Apple Store kiosks – Apple stores include elegant and interactive kiosks that allow customers to explore different features, compare different models and make smooth purchases.</p>	
<p>McDonald's – self-ordering kiosks introduced by McDonald's offer customers an engaging and seamless ordering experience. They help them personalise their orders and simplify the ordering process.</p>	
<p>Tesla showrooms include interactive kiosks that provide customers with detailed information about the company's electric vehicles. They also offer various customisation options and favourable prices.</p>	

Radio frequency identification (RFID) uses radio waves to identify and track products throughout the supply chain. It enables retailers to automate inventory management, improve stock accuracy, streamline replenishment processes and reduce out-of-stocks. RFID increases supply chain visibility, enabling retailers to optimise inventory levels and improve operational efficiency.

RFID tags can be attached to individual products, allowing retailers to accurately track inventory levels in real time. This enables more efficient stock management, reducing out-of-stocks and improving overall inventory accuracy. RFID can also be used at various points in the supply chain, such as during shipping and delivery processes. This helps companies track the movement of goods, improving visibility and reducing the risk of loss or theft.

RFID can also help retailers reduce theft and fraud. By tagging items with RFID, they can be monitored and any unauthorised removal can be detected. This deters shoplifting and improves store security.

RFID technology can make the checkout process faster and more convenient. Instead of manually scanning individual items, RFID readers can quickly read multiple items simultaneously, reducing queues and improving the customer experience. The technology can also be used for product authentication and anti-counterfeiting.

Artificial intelligence (AI) and machine learning (ML) are technologies that enable retailers to automate processes, gain insights from data, and make smart decisions. There are several specific applications of AI and ML in retail:

- Chatbots and AI-powered virtual assistants can handle customer queries, provide personalised recommendations, and assist with purchases. Natural language processing (NLP) techniques allow chatbots to understand and respond to customer queries effectively.

- Artificial intelligence and machine learning algorithms analyse customer data, such as purchase history, online behaviour and demographics, to offer personalised product recommendations and tailored marketing campaigns. This improves the customer experience and increases customer satisfaction and loyalty.

- Using historical sales data, market trends, social media data, and other relevant factors, AI and ML models can accurately predict demand. Retailers can optimise inventory management, minimise shortages and reduce waste.

- Artificial intelligence and machine learning algorithms help retailers optimise their pricing strategies by taking into account factors such as competitor pricing, market demand and customer behaviour. Dynamic pricing solutions can adjust prices in real time, maximising revenue and profitability.



Figure 1. Companies that successfully use RFID technologies

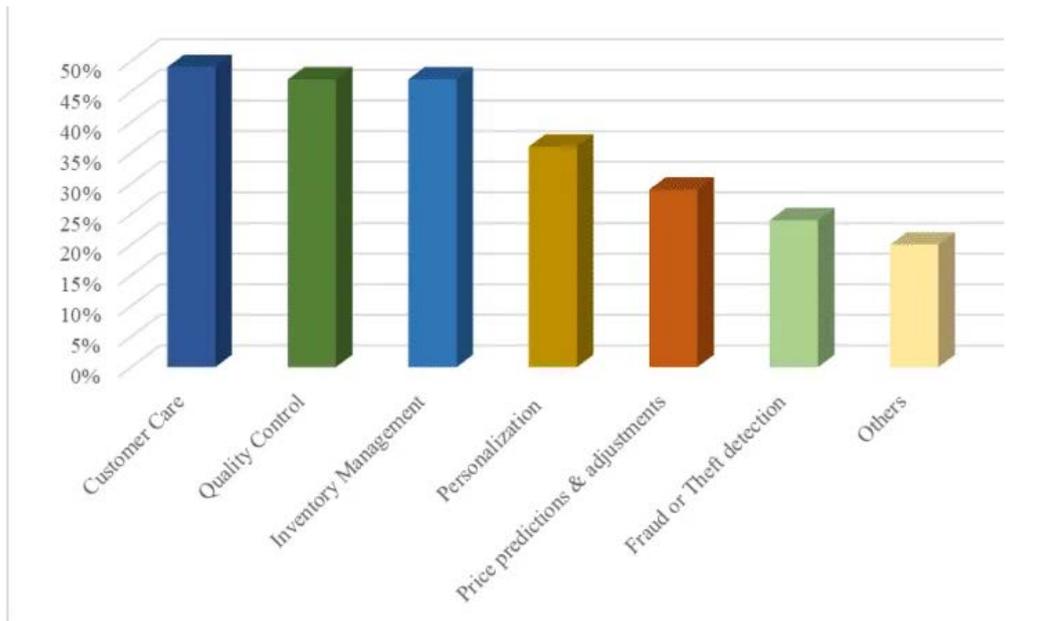


Figure 2. Share of AI use cases in retail, %, by 2022

Source: (Top Use Cases of Artificial Intelligence in Retail Industry)

- ML algorithms can analyse inventory data and predict demand to optimise stock levels, replenishment, and distribution. This helps retailers avoid overstocking and ensures that the right products are available at the right time.
- AI and ML techniques are used to detect fraudulent activities such as fake transactions, account takeovers, and payment fraud. By analysing patterns and anomalies, retailers can detect suspicious behaviour and prevent fraud.

- AI-powered computer vision technology can analyse images and video to provide valuable insights. In retail, this can be used to monitor shelves, analyse customer behaviour in a store, or identify product defects.
- Artificial intelligence and machine intelligence can optimise supply chain operations by analysing historical data, market trends and external factors. This helps retailers improve logistics, reduce costs and increase overall efficiency.

AR/VR	Smart mirrors	Intercative kiosks	RFID	AI/ML
<ul style="list-style-type: none"> • Improved product visualisation • Virtual fitting and customisation • Interactive product demonstrations • Virtual showrooms and salesrooms • Enhanced customer engagement 	<ul style="list-style-type: none"> • Virtual try-on • Style and equipment suggestions • Product information and recommendations • Personalisation and customisation • Social sharing and feedback • Analytics and insights 	<ul style="list-style-type: none"> • Product information and catalogues • Self-service ordering • Placing and fulfilling orders • Registration in loyalty programmes and redeeming rewards • Digital signage and promotions • Customer feedback and surveys • Store navigation and wayfinding 	<ul style="list-style-type: none"> • Inventory management • Supply chain transparency • Loss prevention • Efficient order processing • Product authentication 	<ul style="list-style-type: none"> • Demand forecasting • Personalisation • Optimisation of pricing • Assortment planning • Visual merchandising • Fraud detection • Chatbots and virtual assistants

Figure 3. The role of technological innovation in merchandising

Source: developed by the author

These are just a few examples of how artificial intelligence and machine intelligence are transforming the retail industry. By using these technologies, retailers can automate processes, improve decision-making, enhance customer experience, and drive business growth.

The growth in the share of AI and ML in retail is evident and will continue. This can be seen in Figure 2, which shows the share of AI used in retail by 2022.

These technological innovations are transforming the way retailers engage with customers, manage their operations and drive growth. By combining these advances with effective merchandising strategies, retailers can create compelling shopping experiences and differentiate themselves in the competitive retail landscape.

To summarise the above, Figure 3 highlights the role and functions performed by innovative technologies used in retail merchandising.

4. Conclusions

Technological innovation has revolutionised merchandising, providing retailers with a range of tools and capabilities to enhance the customer experience, optimise operations and drive business growth. The seamless integration of augmented reality (AR) and virtual reality (VR), mobile applications, smart mirrors, interactive kiosks, radio frequency identification (RFID), artificial intelligence (AI) and machine learning (ML), robotics and data analytics has paved the way for transformative changes in inventory management, demand forecasting, personalisation, fraud detection and visual merchandising. Collectively, these technologies are shaping the future of retail, enabling retailers to remain competitive in an increasingly digital and customer-centric landscape. Retailers that embrace and leverage these technological advances in merchandising will be positioned for sustainable success in the dynamic and ever-evolving retail industry.

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