

Harnessing Disruptive Technologies: Strategic Approach to Retail Product Innovation

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Abstract— Innovations in the retail industry, like Amazon's Just Walk Out (JWO) technology, are changing the way people shop by providing a cashierless experience. This article examines how to strategically utilize disruptive technologies for retail product innovation, with JWO as a case study. The examination summarizes JWO technology, its uptake, and the obstacles encountered during implementation. The research also explores the business dynamics of technological advancement, underlining the crucial role of disruptive technologies in improving customer satisfaction, operational effectiveness, and product creativity. The document points out the main drawbacks of JWO technology, such as restricted scalability, expensive implementation and operational costs, and the requirement for frequent technology updates. Suggestions for enhancing JWO technology and its utilization include implementing a licensing or subscription-based business model, incorporating modular design, and enhancing flexibility. The research also covers tactical factors for merchants when adopting innovative technologies, highlighting the significance of prioritizing customer needs, evaluating costs and benefits, considering scalability, building partnerships, and incorporating other technologies. The paper ends by emphasizing the capability of disruptive technologies to change the retail sector and the requirement for companies to find a balance between innovation and practical factors to thrive in a competitive environment.

Keywords—Disruptive Technologies, Retail Product Innovation, Just Walk Out (JWO), Customer Satisfaction, Operational Efficiency, Machine Learning, Artificial Intelligence(AI), Technology Strategy, Machine learning (ML), Data.

I. INTRODUCTION

In the current business landscape, disruptive innovations are central to transforming industries and creating new business models. Companies continuously face challenges in innovating to adapt to and keep up with rapidly evolving customer demands and technological advancements [1][3]. Companies are revolutionizing traditional practices, leading to the emergence of more efficient and customer-centric solutions, while digital technologies, such as machine learning (ML) and artificial intelligence (AI), are accelerating this process. The retail industry is not separate from that. As customers become more tech-savvy, their expectations evolve, and companies try to meet these expectations with self-checkouts and fully automated stores while enhancing efficiency and eliminating wait time. Technologies such as Amazon's Just Walk Out (JWO) and Hudson's Nonstop are prime examples of the new transformational journey toward which the industry is heading. This eliminates checkout lines and offers an easy-to-shop experience. This product and process innovation is powered by sensor fusion, computer vision, and machine learning. It also epitomizes how established industries are disrupted by the strategic deployment of technology [2][4].





Figure 1: Example of Just Walk Out (JWO) implementation

To navigate this competitive landscape, companies must develop robust technology strategies. This paper explores how firms can formulate and implement disruptive technologies, using JWO as a core case study while also examining other similar technological innovations. Just Walk Out (JWO) is a disruptive technology developed by Amazon that eliminates checkout steps in a retail environment. This technology has the potential to enable a seamless shopping experience as a customer enters the store with a card or by palm-hover via Amazon One device, grabs desired items off shelves, and exits without checking out. Computer vision, sensor fusion, and deep learning models enable Just Walk Out. Not only does technology have the potential to upend the traditional retail experience for a shopper, but it also provides analytics to participating retailers. The product allows inventory management in real-time to drive revenue, create operational efficiency, and reduce costs. Just Walk Out also delivers data on customer product considerations and decisions.

Amazon positions the product as a tool to plan retail offerings more effectively, increase profit, decrease labor costs, improve labor efficiency, reduce waste, improve product positioning and space decisions, and gain retail insight [5]. While Just Walk Out has been implemented in Amazon's physical stores, third-party Retail, travel, and stadium partners have embraced its application. Amazon has implemented this technology in the context of Amazon Go, Amazon Fresh, and Whole Food. Notable third-party retail partners include the Hudson Group, Seattle Seahawks, Seattle Kraken, TD Garden, Climate Pledge Arena, and Lumen Field.

This paper explores how firms can develop and implement strategies to deploy disruptive technologies while analyzing Just Walk Out technology through the lens of technology innovation and corporate strategy. The analysis provides technical background on Just Walk Out's history and current state of implementation, as well as relevant challenges to date. It delivers recommendations for Amazon to extract greater value from the product and how retail partners may best engage with the technology. The analysis of Just Walk Out will first include an overview of the technology, a description of associated pain points, recommendations to improve the technology and its use, and the state of adoption.

II. INDUSTRY DYNAMICS OF TECHNOLOGICAL INNOVATION

A. Understanding Disruptive Technologies in Retail

The innovations that create new markets or significantly alter existing ones by delivering simplicity, convenience, accessibility, and affordability, where high complexity once existed, are called disruptive innovations [6]. Disruptive innovations often solve customer pain points such as customer experience, operational efficiency, and product offerings. In the retail industry, this includes waiting for checkout in line, repeating product selection, or even understanding what products or services are available, which can be solved by utilizing disruptive technologies such as cashierless shopping, AR-based fitting rooms, AI-driven shopping recommendations, and even drone delivery.

Cashierless shopping: Many companies are innovating the cashierless shopping experience, making it more efficient for both retailers and customers. This is possible by utilizing a combination of computer vision, sensor fusion, and deep-learning models. This technology allows customers to enter a store, select items, and leave without stopping at a checkout counter while automatically charging the customers for the items they have taken. While Amazon pioneered this technology in the name of Just Walk Out (JWO), many other companies, such as Grabango and Trigo, have also entered the market with their own solutions.

Augmented Reality: Many companies are innovating augmented reality-based applications to boost sales and reduce product return rates. Companies such as IKEA and Sephora are experimenting with this technology to allow users to virtually test the product before transaction activity or shipping. This technology has the potential to boost revenue by increasing sales while supporting product discovery and understanding changing customer and market expectations.

Drone Delivery: Companies such as Walmart and Amazon compete with each other to increase the speed at which customers receive their purchases, which drives customer delight. Drone delivery can disrupt and reshape the supply chain by reducing delivery time and operational costs while enhancing customer satisfaction. This technology has the highest potential to enhance customer experience while helping companies differentiate themselves in a highly competitive retail market. However, one of the main challenges is the lack of regulatory requirements as defined by the government.

B. The Strategic Importance of Disruptive Technologies

Harnessing the full benefits of disruptive innovation or technology poses a strategic challenge to retailers. Integrating these technologies into a retail ecosystem requires careful planning, investment, and a customer-centric approach.

Enhancing Customer Experience: Disruptive technologies could help them differentiate from the competition by streamlining the checkout process, product offering, and shipping/delivery convenience, which is often viewed as a value driver for customer engagement. Consider Amazon's Just Walk Out technology as an illustration by eliminating the checkout process, which is often viewed as a time-consuming and unvalued aspect of retail shopping for the customer. Similarly, augmented reality (AR) fitting rooms help personalize retail shopping at many levels, from selecting colors to trying new sizes. These virtual try-on solutions offer customers the opportunity to experience products in ways that are not possible in traditional brick-and-mortar stores.

Operational Efficiency: Disruptive innovations and technologies enhance operational effectiveness. Artificial intelligence (AI)-powered systems can empower the forecasting of inventory needs, manage stock quantities, and minimize the risk of product returns. For instance, Just Walk Out technology offers instantaneous data on stock levels and consumer preferences, enabling retailers to make better-informed choices regarding restocking and product positioning. These enhancements in efficiency ultimately lead to lower operational expenses and improved profitability.

Product Innovation: Emerging technologies facilitate product innovation while enhancing customer satisfaction and streamlining operations. Retailers can leverage the information generated by these advancements to create new offerings that address changing consumer demand. For example, data collected from stores without cashiers can uncover trends in shop behavior and guide decisions on product selection and store design. Artificial intelligence and machine learning technologies can be employed to examine customer input, resulting in the development of new products that better match consumer preferences.

III. CASE STUDY: Just Walk Out (JWO)

Even though there are many companies, such as Trigo and Grabango, we will consider Amazon's Just Walk and Out (JWO) to understand the challenges and strategic obstacles that corporations like Amazon need to balance, which may not be the challenges of a startup environment. This would also help to understand the challenges faced in retail space competition and how companies need to pivot their strategies to accommodate new changes.

A. Overview of Just Walk Out Technology

Just walk-out technology is an advanced system that allows shoppers to enter a store, select items, and leave without stopping at a checkout line. The technology uses sensors, cameras, and artificial intelligence to track the products that customers take off the shelves and automatically charge their accounts when they leave the store. JWO was introduced by Amazon in 2016 and has since been implemented in

select Amazon Go stores. Customers must first download the store's app and register the payment method. Once inside the store, they scan the app at a turnstile, unlock the doors, and grant access. The technology then tracks customers' movements and records the products they pick up. When customers leave a store, the technology automatically charges their accounts for the items they take. This technology uses several sensors, including weight, pressure, and motion sensors, to track products. The weight sensors were placed on the shelves and detected when an item was removed, whereas the pressure sensors were detected when items were placed back on the shelves. Motion sensors detect the movement of customers as they walk around a store. Cameras are also strategically placed throughout the store to capture images of the products customers pick up and their faces.

Just Walk Out technology is not the only player in this field; companies like Trigo and Grabango are also recognizable providers of frictionless checkout solutions for retailers. While they share the same goal of improving the shopping experience for customers and reducing labor costs for retailers, there are some differences in how they approach this problem. Trigo [7], an Israeli startup, also offers a frictionless checkout solution for retailers using a combination of cameras and artificial intelligence. However, Trigo's technology is designed to be retrofitted into existing stores, making it a more cost-effective solution for retailers that do not want to build new stores from scratch. Grabango [8], another player in the frictionless checkout space, uses a combination of cameras and machine learning to track the products customers take off shelves. Technology can also identify when items are put back on shelves and can detect when customers are in a group, making it easier to split bills. Just Walk Out technology, and Trigo use a combination of cameras and sensors, whereas Grabango relies primarily on cameras. Just Walk Out technology is backed by Amazon, while Grabango and Trigo are startups. Each solution has its benefits and potential disadvantages, and retailers must carefully consider which solution best fits their specific needs.

One of the main benefits of frictionless checkout technology for retailers is that it reduces labor costs.

With this technology, retailers no longer need to hire cashiers to manage checkout lines, resulting in significant cost savings. Another benefit is that the technology reduces theft and increases inventory accuracy. The sensors and cameras in the store track the products that customers take off the shelves, making it easier to identify when items are misplaced or stolen. This technology also provides retailers with real-time data on inventory levels, which can help them make more informed decisions about restocking and inventory management. The frictionless checkout technology provides customers with a faster and more convenient shopping experience. They no longer need to wait in long checkout lines, and this technology eliminates the need to scan each item individually. This technology also gives customers more control over their shopping experience, as they can see the items they have selected and the total cost of their purchases in real time.

B. Adoption of technology

JWO technology lives not only in Amazon's own physical stores but also in Retail, hospitality, travel, and stadium environments. Just Walk Out technology is available in more than 50 Amazon stores and more than a dozen third-party customer stores." [9] Amazon stores and third parties have generated millions of transactions to date, further validating the ability of JWO. The path taken to reach this point started with internal implementation before piloting and selling to third parties, a strategy we have previously discussed during our AWS case in this course. The implementation path included Amazon Go, Amazon Fresh, Whole Foods, and Third Parties.

After much delay, Just Walk Out technology was first rolled out to the flagship Amazon Go store in Seattle, WA, in January 2018.[10] Anyone with an Amazon account and the Amazon Go app could shop at a location beginning on its opening day. Less than a year later (February 2022), Amazon launched the JWO in Whole Foods in Washington, DC. Amazon integrated the Amazon One Palm payment with JWO to allow patrons to enter the store and identify themselves for shopping tracking. The feedback generated from a survey of shoppers at Whole Foods is that the sheer number of cameras can be concerning

and hard to ignore but that the overall convenience makes it worthwhile.[11]

Third-party implementation of the JWO has focused mainly on Retail, hospitality, travel, and stadium environments. Hudson, a travel retailer, for example, has used this technology to offer busy travelers the ability to check out free shopping. Travelers can quickly get in and out of the stores with their snacks, drinks, and travel essentials, which helps them alleviate the stress of making it to the boarding gate on time. Sports arenas such as Climate Pledge Arena and TD Garden use JWO to allow guests to quickly grab food and drinks while limiting the time spent at the concession stand [4]. With these partnerships and the early adoption of JWO, Amazon has been able to demonstrate the ability of the technology to function as intended. Considering that Amazon has over 500 stores and has only rolled out this technology across 50 Amazon stores (including Go and Fresh), Amazon has much more room to implement software internally. Externally, Amazon can continue to target segments that they have been able to prove to be valid use cases, but it can also start to target other retailers such as consumer electronics (Best Buy) or supercenters such as Walmart or Target. Growing adoption in proven categories and new spaces will provide the insight needed for Amazon to continue to improve its product and hear from customers what is going well and what needs to change.

C. Pain Points of Just Walk Out Technology

As with any new technology that needs to change customer behavior, JWO has many challenges and pain points.

Economy of scale: The economy of scale is the biggest challenge faced by JWO technology today. Although the reliability of technology is high in small retail stores with a limited product range, it has lost its confidence in large stores with a higher product range. This also leads to a chicken-and-egg problem, where deep learning requires the environment to learn while the environment is not confident in implementing the technology. As a result, its significantly high implementation and operational costs are unjustifiable, with the limited cost benefit this technology could bring. In addition, its ability to integrate with existing

technologies is limited. As the range size of the store and the product range increase, the number of sensors, cameras, and other hardware requirements to track both customer and inventory increases. This makes it challenging to restructure shelves and rearrange SKUs. In addition, expanding the existing retail space would not be the same as modifying traditional retail spacing, as it requires more technical support and adds implementation costs.

Cost of Technology: The primary barrier is the cost of acquiring and maintaining this technology. The financial commitment required far exceeds any type of ROI, mainly when operating in a retail industry with a thin margin of profit. There are two main costs to consider when evaluating a technology. Implementation and Operational Costs. Implementation costs for traditional retail businesses vary from place to place based on the size of the facility, location, construction cost, government regulations, infrastructure, technology, staffing, etc. However, implementing Just Walk Out (JWO) or similar technology would help reduce the cost of staffing, but we cannot eliminate it, at least in the current situation. Additionally, it will increase infrastructure, construction costs, and technology costs due to increased sensors, cameras, and high-capacity servers to support deep learning algorithms. The other cost to consider is the operational cost. Traditionally, Labor costs involve hiring staff for counters and inventory/shelf stocking. These staff members are not highly skilled but are trained to maintain the store. In JWO, staff members are still significant in preparing the product display and receiving and unpacking backend shipments. Additionally, JWO requires a skilled, specialized labor team to maintain servers, cameras, sensors, etc. These additional technological parts also require periodic servicing and replacement.

Technology Upgrades: Considering the shorter life span of sensors and cameras, equipment replacement might need to be done more frequently, causing software compatibility issues, integrating older technology with newer technology, and increasing cost. Trigo offers a frictionless checkout solution for retailers by using a combination of cameras and artificial intelligence. However, Trigo's technology is

designed to be retrofitted into existing stores, making it a more cost-effective solution for retailers that do not want to build new stores from scratch. Grabango offers a frictionless checkout space and uses a combination of cameras and machine learning to track the products that customers take off shelves. Technology can also identify when items are put back on shelves and can detect when customers are in a group, making it easier to split bills.

Customer Interaction: Customers who seek a pleasant shopping experience and want to connect with shopping assistants who can advise on the new styles will seek our brick-and-mortar stores. Other relevant concerns include the complexity of the technology, potential consumer resistance to embracing technology, limited availability, and security and privacy concerns.

D. Recommendations to Improve Just Walk Out Technology and its Use

With considerable challenges, such as limited scalability and the cost of technology for implementation and maintenance, JWO is still in the early stages of innovation and is ahead of market requirements. Some recommendations could help accelerate implementation and support scalability.

Licensing or subscription business model: Its higher implementation and operation costs have limited other retail companies from considering it for testing. This challenge can be overcome using a subscription model. Amazon can pick up some initial implementation costs and offer products as service packages. Amazon can also collaborate with other retail companies that want to continue investing and learning about JWO technology by licensing the technology for limited use, collecting royalties, and expanding service. These collaborations will help JWO develop new algorithms, improve the sensors and cameras used in the technology, and even optimize the software to handle unexpected test scenarios. Additionally, this implementation across a wide range of stores helps spread the development and operational costs across companies.

Using Modular Design: Amazon could use a modular approach to design its JWO modules instead of offering technology as a solution under SAAS or a platform

business model. For example, Amazon can build store/shelf modules with JWO as a feature and sell them to retailers. This allows any retailer to scale up or down, depending on the changing requirements. This could also contribute to reducing restructuring costs, flexible software modules, and standardized components that can be used to adapt to different stores and retailers. This can make Amazon a turnkey solution provider, and it can also use its cloud-based capability to reduce costs and improve scalability.

Increased Adaptability: Amazon's just-walk-out technology is still in the early stages of development. Considering the ROI in the retail industry, it would be more beneficial to capitalize on the technology by partnering with airports, stadiums, universities, and hospitals to start kiosk-type stores and increase scalability to the retail market once customers adapt to the system.

IV. STRATEGIC CONSIDERATIONS FOR RETAILERS

Even though disruptive technologies offer a variety of advantages over the current process or product, retailers must be conscious of the execution of these technologies and how the customer and the industry receive them. Companies can succeed in executing such strategies if they focus on the following:

Customer-centric Approach: Any Product design should focus on customer satisfaction. This is true for all disruptive technologies, from Netflix to digital cameras. Every disruptive technology is successful because it focuses on customer satisfaction. Understanding and addressing customers' needs and preferences and providing the time and support needed to understand the change are the keys to executing disruptive strategies.

Cost-benefit Analysis: The cost associated with implementing technology, such as JWO, is challenging for most retailers. As long as they can reuse the existing structure with minor technological modifications to support disruption, they are confident that they can try it. However, the cost associated with modifying the complete structure of the operations, training the staff to support new operations, and even halting the current operations until remodeling is proven to be higher than

the benefits JWO offers. Technologies such as JWO could add long-term value generation; however, the effects it causes cannot be justified for incumbents such as Amazon.

Scalability: Scalability is a challenge for disruptive technologies. As innovation is new to the market, there is very little information available and even less information on challenges and opportunities to improve. It can only be improved with the mutual virtuous cycle, meaning that an increase in adopting this technology helps to challenge and address any drawbacks efficiently. Although new technology may work well in a small pilot project, scaling it to multiple locations with different product assortments and customer bases can present challenges.

Partnerships and collaborations: Retailers can address the initial cost of adopting disruptive technologies by establishing partnerships and collaborations, focusing on collaborative development and adoption strategies. This can significantly reduce the costs and risks of adoption and enhance the utilization of cross-expertise and resources.

Integrating new technology: There are various opportunities to leverage and integrate technology, such as simply walking out with other disruptive technologies to maximize the economic value created in society. AI for personalized product recommendations, targeted marketing, and dynamic pricing can benefit both retailers and customers. IoT for inventory management reduces the likelihood of stockouts, and other technologies, such as blockchain for supply chain transparency, could add significant value and justify investments for future value creation.

V. CONCLUSION

Disruptive technologies like Amazon's Just Walk Out (JWO) are transforming the retail industry by addressing key pain points and enhancing the customer experience. While JWO and similar cashier-less technologies offer significant benefits in terms of convenience and operational efficiency, their widespread adoption faces challenges related to implementation costs, scalability, and customer acceptance.

To successfully capitalize on disruptive technologies in retail product innovation, companies should structure their implementation strategy around customer-centric approaches, focusing on addressing customer needs and changing trends. While new disruptive technologies have the potential to push an incumbent out of business, it is also necessary to understand the economic value created to justify the investments. Scalability issues and technological challenges can better be addressed with partnerships and collaborations to minimize capital investment. Additionally, utilization of other technologies could help maximize benefits.

As the industry evolves, competition and customer expectations become more challenging. Companies positioning themselves to address these challenges will succeed in setting benchmarks and capturing market share while improving their operational efficiency and bottom-line profit. However, success will depend on the ability to choose and balance innovation with practical considerations such as cost, scalability, and implementation.

Future research should focus on overcoming current limitations of technologies like JWO, exploring new applications across various retail segments, and assessing the long-term impact of these innovations on the retail industry and consumer behavior.

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