



E-Commerce Trends- A Service Enterprise Engineering Perspective

Vignesh Ramanathan, Graduate Student & SEE Fellow

Vamsi Srikar Yellayi, Graduate Student

Shah Karim, CEO, SafeRock

Paul Funari, Vice President, UPS Security Services (retired)

James Wilk, Senior Manager, Accenture, LLP

Charles R. Schneider, Founder and Chairman, U.S. Security Associates, Inc.

Vittal Prabhu,* Professor and Director, SEE 360 Initiative

Service Enterprise Engineering (SEE 360) Initiative

Engineering the 21st Century Economy

see360.psu.edu

*Corresponding Author prabhu@engr.psu.edu

What is e-commerce?

Since the advent of the internet, the way business is conducted has changed greatly. This change has manifested itself in the form of the rise of e-commerce since the 1990s. Plunkett et al. (2015) define electronic commerce as **“the use of Internet and other networks (e.g., intranets) to purchase, sell, transport or trade data, goods and services.”** Traditionally, the word *e-commerce* was used only to define businesses involving transaction of goods with the internet as the enabling medium. This is normally associated with entities such as Amazon and Wayfair. Some prefer to use the term *e-business*, instead of *e-commerce*, for all kinds of business conducted online, such as servicing customers, collaborating with business partners, delivering e-learning, and conducting electronic transactions within organizations. Examples of such activities include Airbnb, Uber, Slack, edX, and PayPal. For this paper, *e-commerce* shall be referred to with respect to Plunkett’s definition.

Today, e-commerce is a global phenomenon. Even though the e-commerce boom originated in the U.S., two of the six largest internet companies in the world by revenue today are Chinese e-commerce ventures. In 2017, JD.com reported an annual revenue of \$55.7 billion, while Alibaba reported an annual revenue of \$23 billion. Other notable players in this field are Japan's Rakuten, which reported a revenue of \$6.3 billion in 2015; Brazil's B2W, which reported a \$3.3 billion revenue in 2016; and Germany's Zalando, which reported a revenue of \$5.5 billion in 2017.

During the early stages of e-commerce, many smaller players competed for the emerging market. At that point, e-commerce made it easy for small and medium-sized enterprises (SMEs) to arise. Entrepreneurship was on the uptick, enabled by the internet, which made previously cumbersome tasks comparatively easier. This was apparent during the dot-com boom of the early 2000s. However, a few enterprises have consolidated themselves in this space, such as Amazon and eBay, becoming multi-billion-dollar companies in the process, with Amazon reporting a revenue of \$177 billion in 2017 and eBay reporting a revenue of \$9 billion in 2016. Most of the online retailing industry can be considered as electronic marketplaces. An e-marketplace is an electronic space where different buyers and sellers meet and conduct different types of transactions. Like any market, electronic or physical, these platforms have the following functions:

- Enable transactions to occur by providing a meeting place for buyers and sellers.
- Enable information flow between buyers and sellers.
- Provide services associated with transactions, such as payments. Note that these transactions must be secure and adhere to local laws and regulations as well.
- Provide auxiliary services such as customer support, reimbursement (if necessary), security, auditing, and legal services.

Electronic marketplaces are comprised of the following components:

- i. **Customers** – These could be individuals or businesses.
- ii. **Sellers** - These stores offer different products and services and can be owned by companies, government agencies, or individuals.
- iii. **Products and services** – Apart from physical goods, e-marketplaces have the unique ability to sell digital goods. This allows for streaming services such as Spotify.
- iv. **Infrastructure** – Includes databases, computer servers, software, and electronic platforms.

- v. **Front end** – The means by which customers interact with the seller. Includes the seller’s portal, electronic catalogues, a shopping cart, a search engine, and a payment gateway, among other components.
 - vi. **Back end** – The operations necessary for the functioning of the business that occur without the knowledge of the customer. This includes inventory management, order aggregation and fulfilment, supplier purchasing, accounting payment processing, and logistics.
 - vii. **Intermediaries** – Typically a third party that operates between sellers and buyers. The function of these intermediaries is to match buyers and sellers respectively and provide auxiliary services such as escrow and security.
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Searching in e-commerce – interfaces and mechanisms

To facilitate users discovering and conveniently browsing through new products or services, businesses engineer several search interfaces through software. Initially simple, these interfaces have progressively grown into complex tools. A progression can be seen as follows:

- i. **Search engines** – Google is the most prominent. In addition to providing the results that a user asked for, a recent feature is targeted advertisement. Based on the user’s browsing history, advertisements are shown for products or services that the user may be interested in.
- ii. **Recommender systems** – A recommender system is an online tool that suggests to users of an e-commerce website potential products to purchase. These are typically based on factors such as the user’s previous purchases on Amazon, demographics, and behaviour of users deemed similar to this user. Extensive use of machine learning is usually seen with such systems. Amazon’s recommender systems have been one of its biggest strengths in e-commerce—these systems use techniques such as item-to-item collaborative filtering that can easily scale up to both the huge number of customers involved as well as the vast catalogue of items available online. Amazon has also had success with sending users personalized mail recommending new items to buy, which requires less automation. As human workers are responsible for these recommendations, the recommendations are often more personalized.
- iii. **Video and mobile search** – This has exploded over the past few years. YouTube is the most prominent among video search entities and is also a hub for advertising. In addition, social media trends such as “unboxing videos” for expensive electronic items are a form of product advertising unique to such media. Another less prominent player in mobile search is Bing.
- iv. **Voice-powered search** – As computers have gained more processing power, voice processing is on the rise. Great strides have been made in voice and speech recognition over the past few years. Enablers of this service are Apple (Siri), Google (through the Google Assistant and Google Home), and Amazon (Alexa).
- v. **Eye tracking** – A growing area of research for e-commerce websites is eye tracking. Several studies show that in a typical website, all parts of a web page do not receive equal interest from a typical user. This behaviour varies depending on factors such as the user’s age. Webpages nowadays are designed with the aim of delivering appropriate content placed in those parts of the page where a user’s eye typically focuses. Websites also employ other strategies to better retain a user’s attention to a page, such as increased interactivity of a web page.



Voice-powered smart assistants represent a new search medium that is easily accessible from one's home

- vi. **Brain-computer interfaces** – This is a growing area of research that holds much promise. A brain-computer interface (BCI) directly translates thoughts that the user wishes to share with the external system. Facebook's Building 8 is attempting to develop a system that allows a user to type at a speed of 100 words per minute using nothing more than thoughts. Elon Musk also has a start-up company, Neuralink, that aims to develop BCIs. While there is little news from existing e-commerce ventures regarding their developments in these fields, enormous potential exists for such businesses through BCIs.

E-commerce has also resulted in new mechanisms by which products are created and consumed:

- i. **Self-customization** – The internet makes mass customization easier.
- ii. **Designs** - The wide availability of accessories makes it possible for a single product to have thousands of different configurations. Nike, for example, has an online NikeiD service to customize shoes.

What goods sell well through e-commerce?

The following sorts of goods sell well in an e-commerce retailing setting:

- i. **Branded goods with reputation** – One of the biggest risks with e-commerce is the lack of security with goods. As one cannot physically inspect these goods, there is a risk of poor quality. Branding alleviates this risk as the customer is assured of a reliable product.
- ii. **Digital products** – Products such as music, e-books, and downloadable movies that cannot be sold as easily and efficiently through a physical store.
- iii. **Packaged items** – Products in sealed containers that are not opened in physical stores sell well. This ranges from canned food products to books.
- iv. **Inexpensive and frequently purchased items** – There's a low risk associated with these items being spurious or counterfeit. This did not historically extend to perishable goods, as the extended shipping period could ruin the product. However, with improvements in fulfilment and last-mile delivery processes, several e-commerce ventures such as Peapod and Blue Apron have made a name for themselves with perishable item delivery. This trend is prevalent in larger cities such as New York City.

Traditional retailing vs. electronic retailing

While the underlying business functions are the same for a traditional brick-and-mortar organization and a “click-and-mortar”/pure-play organization, they differ by several characteristics:

- **Increase in sales volume** – Traditional retailers achieve this by increasing the number of physical stores, new locations, and more shelf space. E-commerce retailers only increase their outreach to ensure they are known to more customers.
- **Use of technology** – Traditional retailers use this to augment existing processes and make them more efficient. Examples of this are self-checkout counters and information kiosks. An extreme example is the Amazon Go concept store, where there are no checkout counters and billing is automatic. E-commerce retailers use technology for ordering, payment, fulfilment, and even reviews. Moreover, some of the products themselves are digital.
- **Customer relations** – Traditional retailers maintain relationships through personal representatives. E-commerce retailers provide anonymized support. E-commerce retailers place a higher priority on customer relations, as negative relations and publicity have a greater potential to hurt e-commerce retailers when compared to traditional retailers.
- **Competition** – Traditional retailers usually do not face much competition, especially in sparsely populated areas. In contrast, e-commerce is a competitive business, as access to most of the internet does not have physical restrictions. E-commerce retailers must differentiate themselves much more aggressively in comparison, by lower costs, greater product variety, or better customer service.
- **Customer base** – Traditional retailers are restricted to local shoppers most of the time. As a result, these customers are usually loyal, in part thanks to the personal relationship cultivated in such stores. E-commerce customers are anonymous to the business and do not usually feel strong loyalty to the business.
- **Personal customization** – Scope for this is low with traditional retailing, but higher with e-commerce.



While e-commerce has seen rapid growth recently, physical stores are still the most prevalent form of retail by volume and profit across the world today

- **Pricing** – Pricing of products is usually static in traditional retailers, especially for everyday use items. Usually, the only major cause of price variation is seasonality. E-commerce retailers have high fluctuation in product prices, even for simple products.
- **Adaptation to market trends** – Traditional retailers are usually slow to react to market changes due to the immense effort required to make changes in physical stores. This is especially true of large entities like Walmart. E-commerce retailers can respond much faster to changing market trends.
- **Additional services offered** – To entice customers, e-commerce businesses often offer additional services such as free shipping and item upgrades in the case of lack of item availability. No such facilities are provided with regular retailers.

Supply chain changes thanks to e-commerce



Given the razor-thin margins that e-commerce retailers operate on, effective supply chain management is crucial to ensure profitability

Traditional supply chains focused on products manufactured by a single business for a specific group of customers. E-commerce retailers require a supply chain that focuses on different priorities by comparison. The following shifts have arisen thanks to the rise of e-commerce:

- **From cross-functional integration to cross-enterprise integration** – Unlike traditional enterprises, e-commerce retailers require large-scale coordination among different entities. This is exacerbated by services such as Amazon’s external fulfilment services. Assisting this are facilities such as ERP (Enterprise Resource Planning) systems and EDIs (Electronic Data Interchanges).
- **From physical efficiency to market mediation** – Supply chain management has almost always been about minimizing physical supply costs in the supply chain. These costs include manufacturing, transportation, and cycle stock costs. Market mediation is the process of matching the quantity and variety of the product through the chain where this product is demanded. This includes safety stock, safety capacity, markdowns, price protection, returns, and lost sales. The latter kinds of costs have become more important with evolving supply chains. Hence, a focus nowadays is to minimize market mediation costs rather than physical supply costs.
- **From supply to demand focus** – The push-pull boundary in most supply chains has gradually grown increasingly upstream in most supply chains. With e-commerce services, product

sales are increasingly demand-driven rather than supply-driven. This has occurred due to various factors, such as better mitigation of the bullwhip effect by companies and better tracking of supply chain information (by means of better information systems).

- **From cost reduction to breakthrough business models** – Similar to the previous point, the focus of managing any supply chain was always to reduce costs. Yet, newer supply chains such as Amazon's have a higher preference for gaining market share and increasing customer engagement. In fact, Amazon makes little to no profit overall, re-investing most of their revenue to services and R&D. This subsidizes many services, such as free two-day shipping with Prime. Added to this are extra services such as weekend delivery, which incurs a higher cost at Amazon's end. Such services allow Amazon to compete with smaller package carriers. For instance, during the third quarter of 2017, Amazon spent 98 cents for every dollar it earned as revenue, making an operating profit of just 2 percent. This is very low for an entity as large as Amazon.
- **From mass market to tailored offerings** – E-commerce has made customization easy for customers through technology on the web that allows easy accessorizing of products. Tailoring also occurs in the form of digital products and recommendation systems. These systems are seen not just for pure digital products, but also physical retailers and targeted advertising.

Benefits of e-commerce

Following are some benefits of e-commerce from the perspectives of organizations and consumers:

i. Benefits to organizations

- Greater reach and access to customers. Can now access international markets easily.
- Reduced cost, as information flow and transmission is much faster. This cost ranges from supply chain costs (such as inventory) to marketing.
- Supply chain improvements through greater availability of information to different entities in a supply chain.
- Allows for mass customization of products and services.
- E-procurement helps save time and reduce costs when obtaining raw materials.

ii. Benefits to consumers

- Greater selection of products and services.
- 24x7 accessibility to products and services through a website. This means that a consumer can browse through products any time rather than being restricted by store hours.
- Greater information at hand that can be used to instantly compare prices of the same product across different sellers.
- Greater convenience, especially with door-to-door delivery and the ability to direct goods to others without having to pick up, package, and ship the product.
- Customers in remote and rural areas who previously had little access to many consumer goods can now avail such services as well.

Limitations and drawbacks of e-commerce

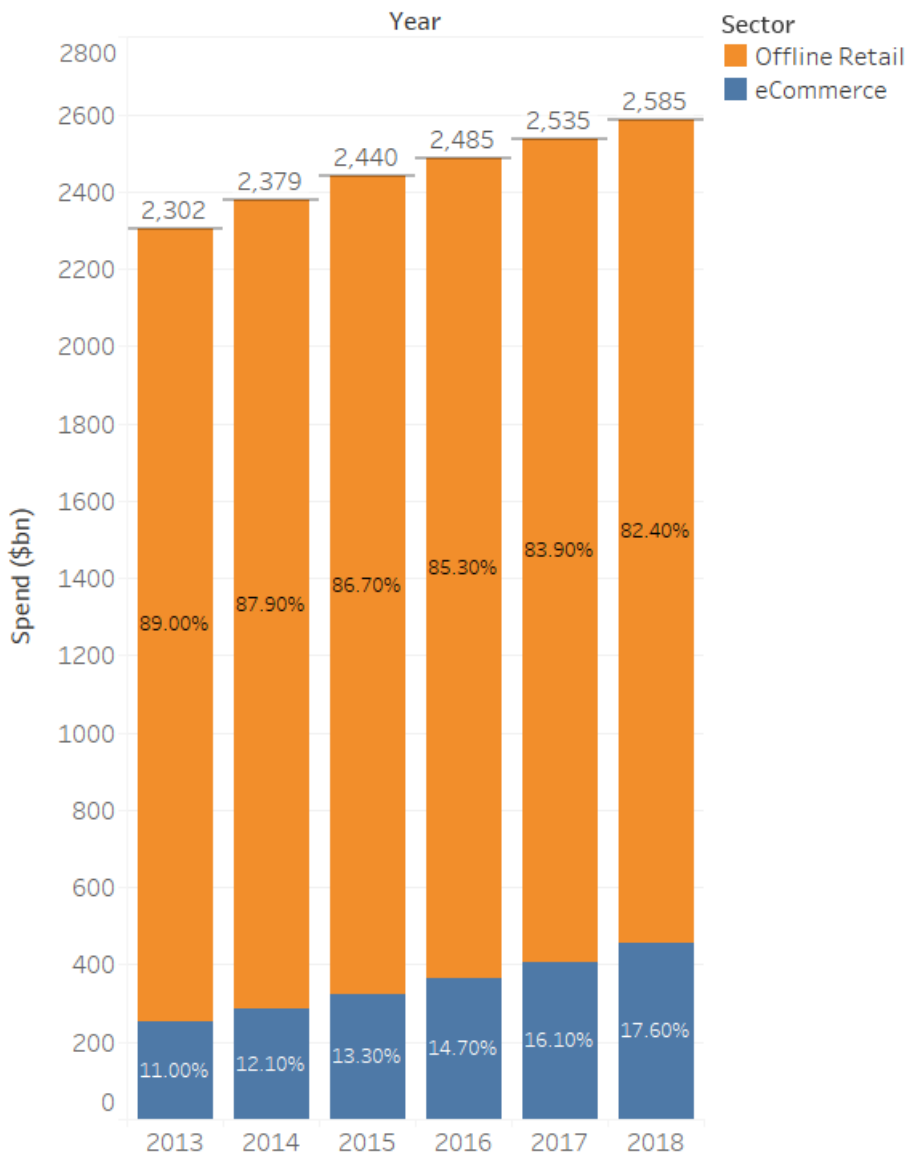
From a regulatory perspective, universal standards are necessary for quality, safety, and reliability. Due to the high fragmentation of this industry, these standards are lacking and enforcing such measures would be difficult.

- It can be difficult to integrate existing legacy information systems and databases with newer platforms. This is a concern due to the rapidly evolving nature of this industry.
- This industry is limited by infrastructure. The bandwidth available for usage restricts the type of content and services that can be offered online. This is a concern with developing nations where infrastructural issues are serious. It is also a problem in countries like the U.S., where several regions see a monopoly with internet service providers.
- While operational costs are minimal, setup costs are high, especially because of the need for costly infrastructure such as dedicated computer servers.
- Highly talented and specialised workers are required for setup and maintenance of the IT resources required to run such enterprises.
- The inability to view products physically often means a lack of trust between buyer and seller. It also makes for higher chances of the customer being dissatisfied with the product or service.
- As this is still a relatively new industry, regulations governing the industry are often ambiguous or simply not present.
- Lower-level warehouse workers report harsh and gruelling work conditions. A widely cited *Business Insider* report in 2018 revealed that Amazon workers in the UK were subject to unrealistic targets to reach (often involving arduous physical labour) and often punished for taking sick time off. Several workers could not take enough time off for bathroom breaks for fear of missing their daily targets. Amazon would enforce a penalty points system that often resulted in the worker's termination. ***Given the increasing volume of e-commerce transactions, great care must be taken to not exploit these workers.***

What lies ahead

Some limitations mentioned in the previous section aren't unique to e-commerce but are symptomatic of a nascent industry. With time, some issues should be resolved. E-commerce has only seen growth over the past few years. Many of the most valuable firms today have flourished thanks to e-commerce.

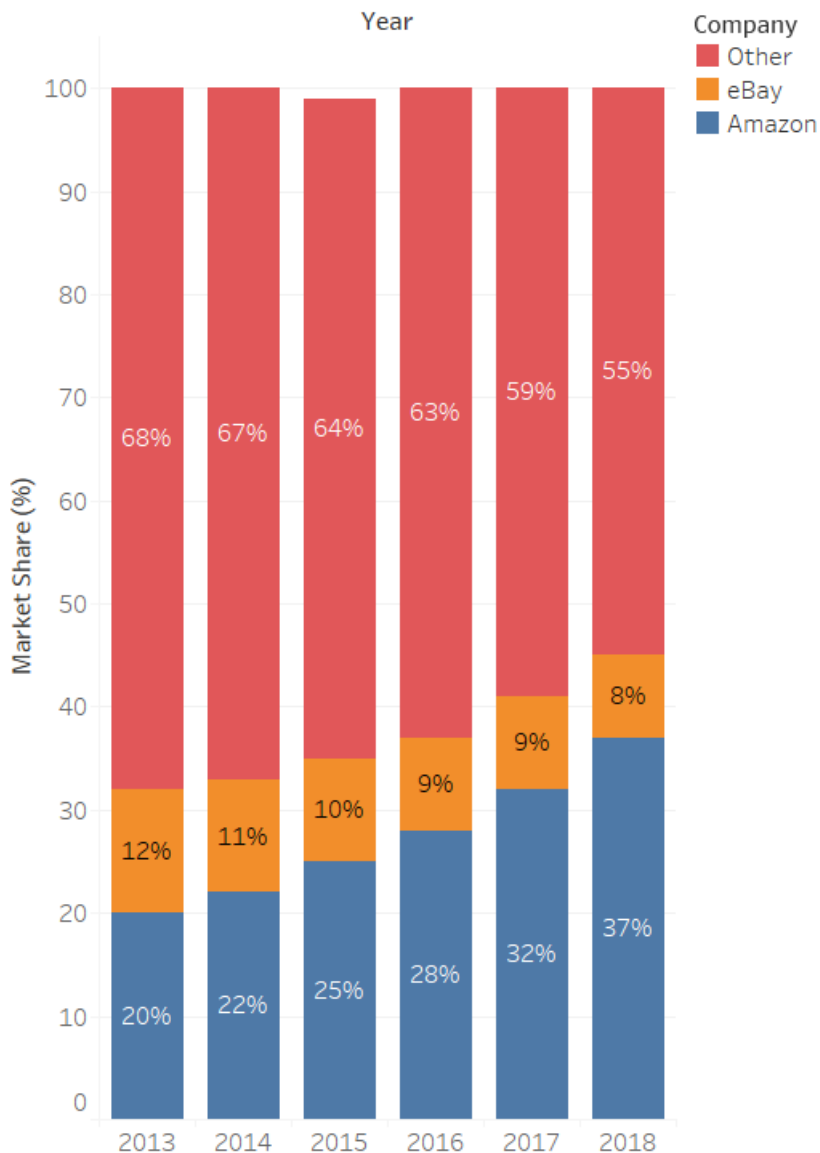
US Retail Spend: eCommerce Mix (\$bn)



Data sourced from Amazon Disruption Symposium – Morgan Stanley Research (2017). The figures shown for 2017 and 2018 were estimates made at the time of the report

Yet, the landscape of the industry is very different from the 1990s. For instance, it is increasingly difficult for smaller players to compete against Amazon and even Walmart to an extent in the e-commerce sector. Amazon's recent dominance spurred the e-commerce growth seen above. This has especially been the case after the establishment of Amazon Prime. The following graph illustrates this market consolidation:

US eCommerce Marketplace Mix (%)



Data sourced from Amazon Disruption Symposium – Morgan Stanley Research (2017). The figures shown for 2017 and 2018 were estimates made at the time of the report

This has been achieved through a mix of several factors. Prime membership is one of the biggest positives in driving Amazon's growth. In addition, the blend of cheap prices, a collection that is unmatched by any physical retailer (which is starting to encompass even everyday necessities), convenience, and excellent customer service (such as free returns) has drastically fueled this shift in the retail industry. Amazon also has many competitive advantages that lead to lower costs, including automation, low real estate costs for warehouses, and better warehouse use as compared to a physical store. These reduced costs mean that there is more capital available to invest in research, development, and innovation. The acquisition of Whole Foods could make same-day delivery possible in the future even for products like fresh produce. Walmart has also announced similar plans of partnering with other delivery services. In March 2018, Walmart announced a goal of being able to deliver fresh groceries to at least 40% percent of U.S. households.

Nevertheless, smaller players can establish themselves in certain sectors. Niche markets, such as customizable t-shirts (which would typically be dominated by small businesses), are seeing an uptick in small and medium-sized e-commerce ventures. Smaller players can also focus on local products to meet the needs of people in a smaller area. Finally, smaller players have a better guarantee of maintaining privacy. While large players can provide many personalized suggestions, this comes at the cost of granting a lot of information access to these businesses, creating many privacy concerns.

The biggest potential for future growth is with m-commerce (or mobile commerce). Previously, the devices that could access the internet were just computers. The growing ubiquity of smartphones has changed that. Moreover, smartphones themselves have become more powerful and are able to handle many complex applications. Businesses such as banking are now increasingly moving to the mobile space. Research has shown that as customers familiarize themselves with certain brands and products, they slowly become more likely to order these products by mobile. In addition, customers have been observed to prefer mobile shopping for low-expense items such as everyday groceries. Customers also develop a propensity to order more frequently, thanks to the convenience offered by such facilities. There has also been a recent surge in smart devices such as Google Home and Amazon Alexa, which have made shopping easy. This trend is only going to grow with more infrastructure development and more devices that can successfully connect to the IoT (Internet of Things).

The growth of platforms on the internet, especially social media, could also be potential for new business models. Increased connectivity and higher access to information has only made things easier for the consumer to make better informed decisions. As it is, the advertising industry has greatly changed over the past few years due to social media. With the increase in consumption of digital products and services, this seems to be a trend that is here to stay.

Drone deliveries could also be a very real possibility. Amazon has already tested this out with their Prime Air delivery service that aims to get goods to customers within a 30-minute time span. Amazon aims at an eventual target cost of \$1 per delivery, with a potential operating cost of \$0.05 per mile per delivery. These drones could theoretically obtain speeds of up to 100 mph and would be restricted to light packages weighing no more than 5 pounds. Another player looking to invest heavily in this field is UPS. According to UPS estimates, an approximated \$50 million could be saved annually by cutting one mile off each of the 66,000 drivers' delivery routes. This would be especially beneficial to those living in remote and rural areas. Domino's Pizza also famously delivered a pizza by drone in New Zealand in 2016.



Drone deliveries hold much promise as future e-commerce ventures

Even within traditional retail outlets, automation is increasing. By 2017, almost every one of Walmart's 4,700 U.S. outlets was equipped with a Cash360 machine, a device built to count cash reserves in the form of both coins and notes. A 2015 report by Citi Research reported that two-thirds of jobs in U.S. retailing are at risk of disappearing by 2030. Even though Walmart is still one of the largest employers in the U.S., it was found to be employing a workforce 15 percent lesser per square foot of store space as compared to a decade prior.

Walmart vs. Amazon

Today's retail space has two significant players: Amazon and Walmart. Walmart was founded in 1962 in Rogers, Arkansas, and slowly rose to dominance, especially in the 1990s as it outpaced former rivals K-Mart and Sears. Walmart operates a total of 11,718 stores worldwide, as of January 31, 2018. They reported a revenue of \$485.87 billion in 2016, making them the world's largest company by revenue. Amazon is a much more recent player, founded in 1994 in Seattle, Washington by Jeff Bezos as Cadabra Inc. Originally an online bookstore, the company quickly expanded to a now successful general e-commerce delivery business. Amazon is now the most valuable retailer in the U.S. by market capitalization, reporting a revenue of \$177.86 billion in 2017. Amazon eventually expanded to a host of other businesses. The Amazon Web Services division is responsible for computing for a significant portion of the technological industry today.



Amazon's e-commerce delivery business has seen rapid growth over the past decade, especially thanks to its Prime service

Amazon is trying to establish itself in the physical retail space with its Amazon Go stores and its acquisition of Whole Foods for just under \$14 billion in June 2017. The latter was a bit of a surprise considering that Whole Foods had diminishing revenue growth figures for every year since 2012. Nevertheless, the acquisition posed certain key advantages for Amazon. While Amazon already sells fresh produce online through its AmazonFresh service, the already existing physical store presence of Whole Foods would be an enormous boon to Amazon's physical store network. At the time of acquisition, Whole Foods had 431 physical retail outlets across the U.S. This acquisition could pave the way for Amazon to offer a ready-to-make meal service, much in the fashion of Blue Apron. In addition, Whole Foods is a brand very much favoured by today's generation, allowing Amazon to tap into a market that has much potential for growth.

Walmart has made several attempts to increase its presence in the e-commerce sector as well. One of their biggest moves with respect to this was their acquisition of the e-commerce business Jet.com for \$3.3 billion in August 2016. This acquisition was for a price much greater than Jet.com's valuation at the time. When looking at a per share price basis, Walmart paid about 80 percent higher than the market valuation of Jet.com at the time of acquisition. Jet.com targets the urban millennial, a departure from Walmart's traditional customer demographic, much like Whole Foods' strongest customer base. This is seen with Jet.com launching its private label Uniquely J, which offers products such as coffee, olive oil, laundry detergent, and paper towels. Walmart's extensive supplier base and subsidiary companies (such as ModCloth and Bonobos) mean that a wide variety of products could be sold under the Jet.com umbrella. Given Walmart's already extensive warehouse network, these could easily double up as fulfilment centers for the purposes of e-commerce delivery.

Walmart also announced a deal with the logistics and delivery giant FedEx in March 2018. Under this tie-up, Walmart announced plans to add 500 FedEx office locations within stores by 2020. At these

locations, shoppers can now pack, print, and ship items. This would allow Walmart to leverage FedEx's extensive logistics expertise. Walmart has also announced plans to offer employees bonuses if they delivered goods to individual houses on their way back home after work. This would be an effective strategy at last-mile delivery for Walmart, given that 90 percent of Americans live within 10 miles of a Walmart store. This is widely seen as a response to the Amazon Flex service that debuted in 2015, where individuals deliver packages to homes on a per-demand basis—similar to Uber's function but for package delivery rather than as a taxi service. Walmart has also joined with Uber itself for last-mile grocery delivery service, established in six cities in the U.S. as of August 2017.

One of Amazon's biggest successes has been leveraging voice-powered search for shopping purposes using the Amazon Echo home device. To counter this, Walmart announced a partnership with Google in 2017 where Walmart would join Google's online shopping marketplace Google Express. Walmart hopes to use Google's expertise with smart home devices (particularly the Google Home) for voice purchasing. Under this new partnership, customers would be able to order Walmart goods by simply speaking to their Google Home devices. Walmart also reported that they would share customer purchase history with Google to easily facilitate re-ordering and provide valuable input for the natural language processing required. Given the struggles of Google Express in online shopping, this partnership seems conducive for both these companies.

Amazon looks to further the Echo's potential with its acquisition of Ring, the maker of internet-connected doorbells and cameras for an approximated \$1.1 billion in February 2018. Before the acquisition itself, it was possible to pair Ring devices with Amazon's Echo Spot, a version of its Echo smart home device that sports an additional screen. This acquisition could help with deeper integration of Amazon products with home security systems, a feature that could be vital for furthering e-commerce operations. Before this, Amazon offered a business service starting in November 2017 called Amazon Key. Under Amazon Key, customers would have to buy a new kit for \$250 that would include an Amazon-made security camera and a smart lock manufactured by either Yale or Kwikset. The lock would then open to admit delivery upon a user's remote request, while the camera would record video for the duration of the delivery. Like Amazon Key, a smart lock manufacturer called Latch struck a deal with Jet.com to jointly pay for installation locks in 1,000 New York City apartments with the aim of making deliveries easier.

Walmart is looking to expand into e-commerce in other markets as well. In June 2016, Walmart announced a partnership with JD.com, one of China's two largest online retailers by volume and transaction value. JD.com possesses one of the largest drone delivery systems in the world and is testing drone delivery vehicles and driverless delivery through an autonomous delivery truck. Such a partnership would be a move against not only Amazon, but other global competitors such as Jack Ma's Alibaba. JD.com also launched a smart retailing store 7FRESH in Beijing in January 2018. In a similar manner to Amazon Go, JD hopes to leverage data from JD's 266 million customers to improve store experiences. 7FRESH stores would have automated shopping carts that follow customers around as they shop. These carts have tablet devices on them that show information about the product and sensors that detect when an item has been selected. Customers can then check out of the store simply through a facial recognition system. 7FRESH also offers a service where customers shop for items and have these items delivered to their homes within 30 minutes instead of having to carry them home themselves.

Walmart also acquired a majority stake in the Indian e-commerce giant Flipkart in May 2018. Walmart acquired a 77 percent stake in Flipkart at \$16 billion, hence placing a valuation of \$20.5 billion on the Indian firm. This signifies enormous growth for the Indian e-commerce giant, particularly since it had a valuation of only \$10.5 billion in 2017 and was valued by investment firms

at \$7.9 billion as late as November 2017. Flipkart also reported an annual revenue of only \$3 billion in 2017, implying that Walmart seems to be paying a large premium for this acquisition. This would be a particularly valuable addition to Walmart, given that Flipkart has remained a serious rival to Amazon in India for many years. Until the bidding period, Walmart was unable to establish retail stores in India because of India's foreign direct investment policy. Its attempted partnership with retailer Bharti was aborted in 2013. Apart from its 21 Best Price wholesale retail stores, it had no presence in the Indian market. This deal would be the perfect opportunity for a foray into the lucrative Indian market. Walmart could then bring its established supply chain practices and lend its expertise in technology and inventory management to Indian stores.

This rivalry can influence other companies in unexpected ways. For instance, Plug Power Inc. is a firm that sells fuel cells used to power forklifts and other warehouse vehicles. Such companies are simultaneously in business with both Amazon and Walmart. In April 2017, Amazon agreed to spend \$70 million on Plug Power's products. It then received the rights to buy 55.3 million shares in the company, which would amount to a 19 percent company stake. Walmart also received rights to pursue the same number of shares, which it was planning on purchasing. However, the initial price quoted to Walmart would be higher, as Amazon's deal alone propelled PlugPower Inc.'s stock price to grow 63 percent.

Amazon Go

A recent development that seems to be a sign of things to come is the new Amazon Go store that debuted to the public in Seattle, Washington in January 2018. This store is meant to be a prototype. However, as of April 2018, Amazon plans to potentially open such stores in six more locations.

What is it?

Amazon has been known traditionally for its e-commerce business, the very antithesis of physical retailing. Yet, Amazon announced plans of physical stores under the Amazon Go trademark. These are unique stores without traditional human cashiers. Customers simply walk into a store, pick up the items they want, and are charged electronically. These stores were announced to Amazon employees in December 2016 and made their public debut only in January 2018.



The exterior of the Amazon Go Store in Seattle, WA

How does it work?

To enter a store, a user must have the Amazon Go app installed in their phone. This app is available on both iOS and Android. The app also has a feature to add other users to this account, such as a family account. To enter any store, a user must scan a barcode through this Amazon Go mobile app to a sensor that is attached to a turnstile mechanism like those seen in major city subway systems.

After finishing shopping, the customer exits through these turnstiles. This causes a receipt to be generated through the smartphone app, along with a “trip timer” to inform the user of the time spent on this shopping trip.

The store is continuously monitored by cameras. The 1,800-square-foot store in Seattle hosts hundreds of cameras. In addition to a regular visual feed, these cameras also incorporate infrared sensors to detect movement through heat. Each product in the store has a large camera-friendly information code.

To aid information gathering, Amazon also uses customer intelligence and sensor fusion—a process where inputs from multiple camera observations are used to make a single final decision. Developed by NASA scientists, multiple cameras process images through Kalman filtering and incorporate Bayes’ rule to make a final decision as to whether a customer picked up a particular item or not. Other decisions such as the specific customer who picked up the item are similarly decided. Amazon’s sophisticated computer vision and machine learning capabilities are significant to the success of such a complex operation.

Amazon’s database on consumers and their buying habits are also used to aid such decisions. Inferences about a customer’s buying habits can be made based on buying history.

Also, Amazon has filed several patents on using RFID (radio frequency identification device) tags on items. RFID tags have grown more powerful and cheaper over the past few years, to the extent that they can power an automated store today. Given that every item in the Amazon Go store is pre-packaged (including canned food, bags of chips, and plastic containers for items like sandwiches), placing scannable tags on each item is not difficult.

Each of the individual technologies mentioned above would probably lead to sub-optimal decision making. However, when combined, large-scale automation is possible without significant error. A couple of the processes involved in decision making are detailed below through flow charts:

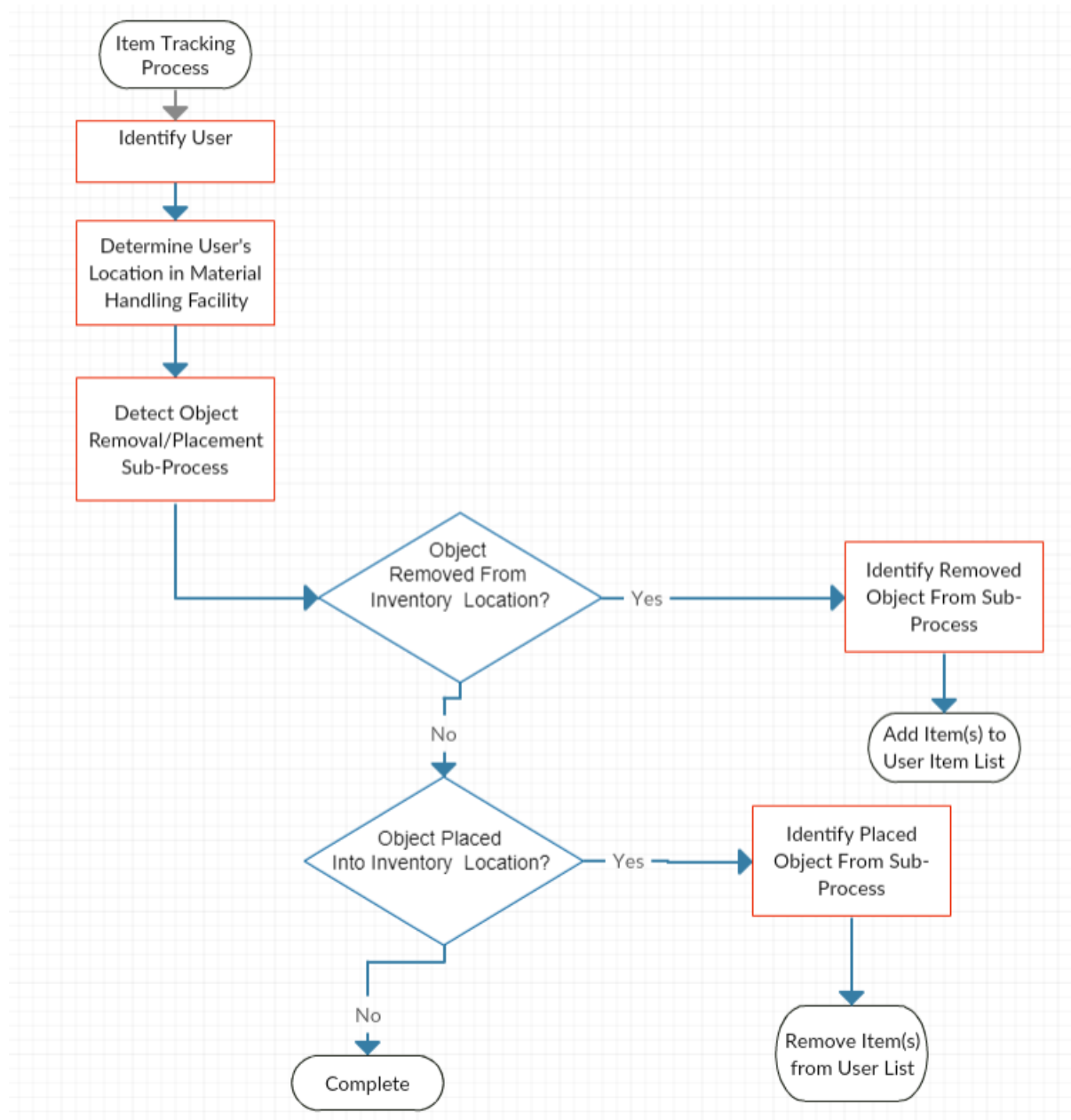


Figure 1: Flow chart for tracking item at Amazon Go. Flowchart data sourced from Amazon’s Patent: Detecting Item Interaction and Movement.

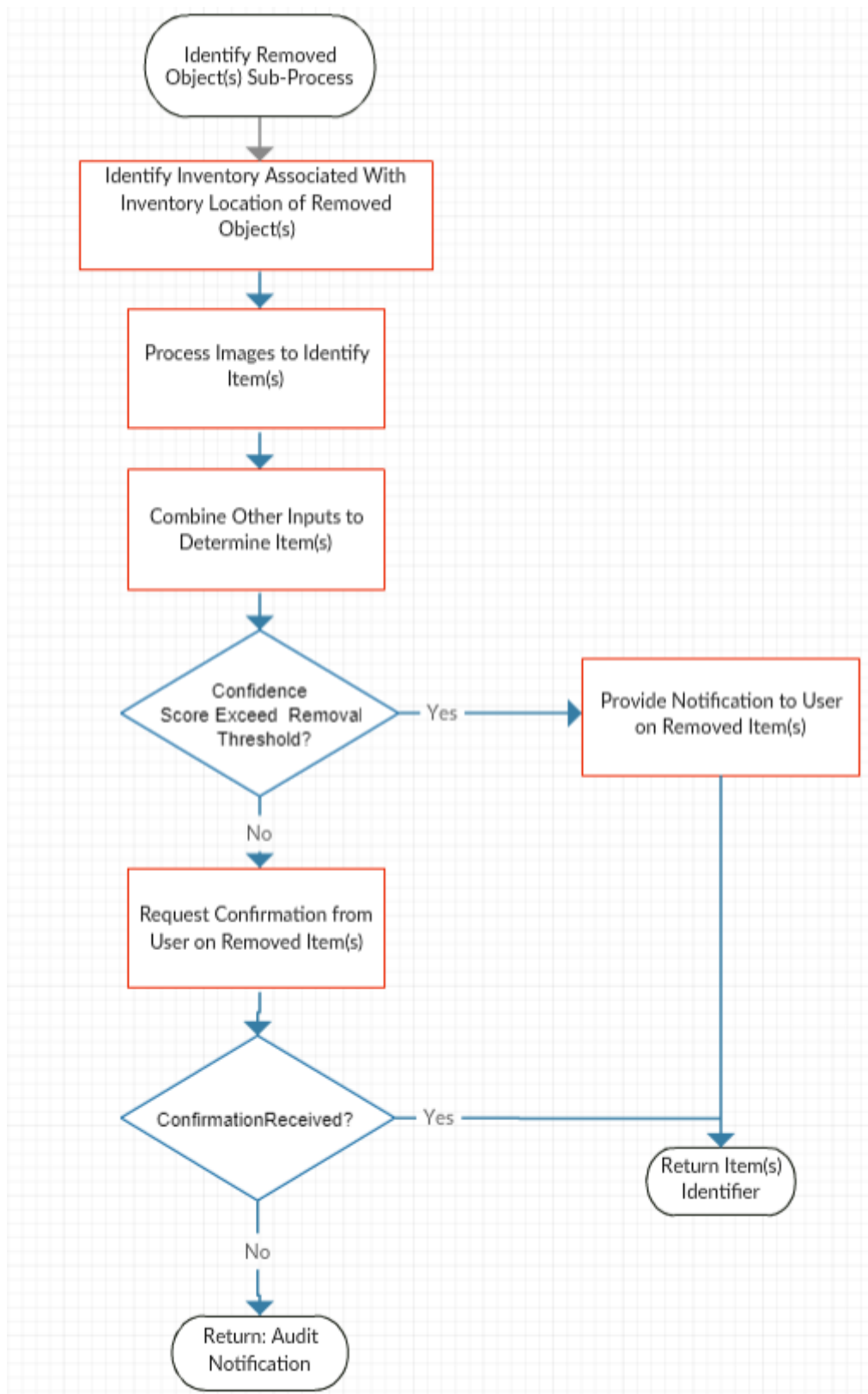


Figure 2: Flowchart to detect removed object from store. Flowchart data sourced from Amazon's Patent: Detecting Item Interaction and Movement.

Strengths and opportunities with Amazon Go

- **Better customer experiences** – At the core of every business lies the customer. With this service, customers have a better experience while shopping by not having to wait at the checkout. Time savings are a big boon for today's working professionals who want to spend minimal time on chores like grocery shopping.
 - **Sustainable supply chain initiatives** – Amazon has known to partner with the non-profit organization Feeding America to dispose of excess inventory on its Amazon Fresh service offered for Amazon Prime members. In 2016, U.S. fulfillment centers donated enough food to provide for 5.3 million meals. Given the much larger volume of inventory that would be held at Amazon Go stores, a significant opportunity is present for Amazon.
 - **Opportunities with other industries** – If this experiment proves to be successful, the potential to disrupt many other industries with similar services would be high as well. Two examples of such businesses would be libraries and restaurants.
 - **Development of Amazon's own brand** – Many traditional retailers have developed their own in-store brands that sell everyday products at low rates. Amazon has eschewed this model so far. However, the presence of physical stores could make this a viable option for Amazon, given their expertise at reducing costs for any product.
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Drawbacks of Amazon Go

- **Privacy concerns** – The customer ends up inadvertently giving Amazon a lot of personal information. Continuous store surveillance, necessary for the functioning of such stores, can make customers uncomfortable. In addition, Amazon stores use transaction history to make behavioural inferences on the customer, and each customer is identifiable by their unique IDs required to enter a store.
- **Job loss** – This would be the biggest drawback of Amazon Go stores. The Bureau of Labor Statistics states that there were 2.7 million individuals employed in grocery stores by retailers in the United States in 2016. Among these, 856,850 were identified as cashiers. Most of these jobs would be under threat if such stores were to become prevalent. Such mass unemployment could have significant economic consequences for a large section of the population. While rapid adoption of technology in industries would lead to the creation of new jobs (such as service and maintenance of such equipment), the number of jobs created won't necessarily equal the number of jobs displaced. Moreover, significant retraining of such workers would be required.
- **Risk of unstable systems** – These stores are heavily dependent on electronic systems. While fail-safes and redundancies would be built into such systems, technical glitches still hold potential for enormous consequences. Moreover, the vast number of electronic systems mean that the cumulative probability of electronic failure in a store would not be insignificant.
- **Product returns** – A core tenet of the American retail experience and Amazon's present operations is product returns. This would be a challenge with automated stores.
- **Loss of human interaction** – Customers prefer personal interactions during their shopping experiences—possibly contributing to the popularity of farmers' markets in the U.S. An Accenture study in 2016 showed that 83 percent of survey respondents prefer human interactions over digital channels to resolve customer services issues. Amazon Go would be a step away from such trends.

Data and e-commerce

All these advances have been possible only thanks to the vast amounts of data being tracked and stored today. These firms source data in different ways. According to Bradlow et. al, big data in retailing has five dimensions – customer, channel, time, product, and location:

- **Customer** – Individual customers or those enrolled together in a family plan. Methods of tracking these customers include loyalty programs, credit cards, IP addresses, and registered log-ins. User-generated content in social media is also increasingly used.
- **Channel** – A rise in omni-channel retailing means that there are now more sources of data to be processed. Customers are increasingly engaging in “research shopping,” browsing products through one channel and purchasing in another. For example, a customer can examine a pair of shoes at a physical store but buy them online at a lower price. Hence, efforts are being made to integrate data across different channels to better map out a customer’s journey across various touch points.
- **Time** - Historically, retail data was analysed by looking at data aggregated across a monthly or weekly level. With better tracking of individual goods through technology such as RFID, continuous measurement of traits such as customer behaviour, product inventory levels, and assortment is possible.
- **Product** – Information about products can include brand premiums and product similarities. The latter is used at times to try to cluster items together to achieve market segmentation.
- **Location** – The ability to use the geospatial location of customers at any given time has provided retailers with new insights.

A challenge for many retailing firms is the use of “better,” albeit recent, data. It may be that data exists across all these dimensions at a very granular level. However, building a model out of old data would not only be useless, but could also be detrimental if the results were used for actions such as pricing products.

Data for products in retail was traditionally obtained through barcode scanners (for point-of-sale transactions) coupled with inventory data from ERP systems. Sophisticated tracking of data has arisen. Walmart, for instance, sources data through Facebook, Twitter, and Pinterest. A Walmart account is active on each of these platforms that aims to build brand loyalty and increase user engagement. These pages usually post product suggestions, but also make announcements regarding company achievements and other initiatives taken. Twitter is typically used for customer service too. The Pinterest account is an interesting user engagement strategy. Walmart launched a competition in September 2012 that offered users a chance to win a \$500 gift card if they posted images of products that helped them lead more eco-friendly lives using the hashtag #WalmartGreen. Apart from advertising and user engagement, these help companies gather data on individuals active on such platforms.

Walmart hosts a 125,000-square-foot facility in Caverna, Missouri near the Missouri-Arkansas border. Fifteen miles away from its corporate headquarters in Bentonville, Arkansas and maintained as a data center, this is a heavily guarded facility nicknamed Area 71 with heavy steel gates. It is also self-sufficient and well protected from natural disasters. While details of this facility are scarce, it is known that it is used to control lighting, climate control, and in-store music for each of its stores and to develop trends and models for purchasing and stocking items. An example of such an instance was in 2004, when Hurricane Frances hit the Atlantic coast. Based on data obtained during previous hurricane strikes, it was observed that strawberry Pop-Tarts sold at a rate about seven times greater

than normal. Hence, these items were stocked in far greater amounts in Walmart’s Florida outlets and sold quickly.

In 2004, Walmart was reported to possess 460 terabytes of data. This would have been more than the capacity of the open source internet itself at the time of reporting. While there is extensive tracking of traditional metrics such as inventory and point-of-sale counters, other modes such as tracking individual customers through loyalty programs exist. Walmart is also developing facial recognition technology to monitor shoppers, according to a 2017 report. This was developed to detect unhappy customers and alert store representatives to address their concerns. The Chinese e-commerce giant Alibaba is also investing heavily in augmented reality, leading investments in two of China's largest start-ups that focus on facial recognition technology: SenseTime and Megvii. SenseTime software has been used in China's credit system that ties a social score to each citizen, as well as video surveillance to identify criminals through facial recognition.

The Amazon Echo assistant has grown more popular, giving Amazon wider customer access. An estimated five million devices were sold in the two-year period after the product launch. According to Nikko Strom, an AI scientist at Amazon, the vast amounts of data collected have helped make advances in voice processing—machines being able to isolate a particular voice in a conversation, as well as to filter out ambient noises in the background.

Another potential use of data for Amazon is advertising. Amazon runs its own ad business to generate revenue, much like Google and Facebook. Historically a small player compared to its rivals, the decade-old business generated a revenue of \$2.8 million in 2017. Yet, Amazon’s recent influx of data through the Echo and better data analytics could soon transform this. Unlike a physical retailer, Amazon’s web presence means that it can analyse other customer traits, such as their browsing habits. Amazon’s acquisition of the popular video game-streaming website Twitch gives the retailing giant other platforms on which to display its advertisements.

In light of the potential risk behind gathering so much consumer data, consumers could be asked the following questions to gain further insights into their understanding and reaction towards this phenomenon:

- i. Would you ever buy products directly from Facebook, Twitter, Instagram, or Snapchat rather than from a merchant’s own website?
- ii. If yes, why?
- iii. Have you ever bought anything because of a recommendation or “share” you’ve seen on the above social media?
- iv. What is your preferred method for online purchases?
- v. Have the recent data breaches with Facebook made you less likely to shop through online retailers?
- vi. Do you believe your data is safe with Amazon and that your personal details have not been leaked to an external third party? (1- strongly agree to 5 - strongly disagree)
- vii. If you are aware that your anonymized data is being sold to external advertisers, does it make you less likely to shop online?
- viii. If you are aware that your non-anonymized data is being sold to external advertisers, does it make you less likely to shop online?
- ix. How important would you rate the security of your personal information that you enter on e-commerce websites?
- x. With the advent of stores such as the Amazon Go, do you believe the amount of data being collected on your online shopping habits may sometimes be good/useful?

Gathering data: Risks, policy reactions, and the future

The increasing amount of data being gathered is not without risk. The recent Cambridge Analytica scandal revealed that CA harvested data from up to 87 million users on Facebook. Most of these users were from the U.S. and it has been alleged that this data harvesting wielded an influence on the 2016 U.S. presidential elections. Apart from directly mining data off third-party apps on Facebook, platforms like Amazon's Mechanical Turk were also used to harvest data from users. This data was collected with the aim of influencing how certain people think. Models were built using this data to try to convince people to vote for a particular candidate through targeted media and advertising. While the exact influence of these techniques remains unclear, the very possibility of a person's thoughts being influenced by such factors is dangerous.

Given the kind of data being gathered especially through smart devices, information that reveals a lot about ourselves could potentially be extracted. Companies have realized this. An internal video from Google's X division in 2016 that was leaked to the media in 2018 revealed a vision of the future, where each user's data trail was maintained in a digital ledger. This ledger could be used initially for purposes such as providing product suggestions at an individual user level. Over time, it was envisioned that a species-wide ledger of such data could shed insights on human behaviour. The creators of this video likened this to understanding more of human nature by unravelling the genetic code. Such an undertaking could be potentially beneficial for mankind, possibly leading to an understanding of what causes mental trauma. Simultaneously, it could be dangerous if in the wrong hands. If corporate entities were in possession of such data, ***there is no guarantee that businesses would not place their own motives of profit and market penetration above ethical and moral considerations.***

Considering the Cambridge Analytica scandal and other trends regarding user data, the General Data Protection Regulation (GDPR) was passed by the European Union in May 2018. This act aims to provide stricter guidelines detailing exactly what companies could do with a user's data and what they couldn't. For instance, it clearly states that companies would not be able to sell a user's information to third parties. In addition, EU residents could request that a company reveal the nature of information stored in internal databases pertinent to the user. If the resident wishes, this information could be deleted permanently from a company's internal servers, at no charge. The act also outlined more severe penalties for possible violations of this law, up to 4 percent of a company's annual turnover. For entities such as Facebook, Google, and Amazon, this would entail millions of dollars in fines if such terms were violated. ***Similar measures would need to be adopted across the world with regular updates to ensure that data does not get misused.***

Amazon, Google, Apple, and Microsoft have all built their devices so that data is transmitted to company servers only after the devices record a key phrase such as "Okay Google." One can also manage recordings through the Alexa app or Google's interface. However, while Apple deletes recordings after two years and keeps recordings anonymized, Amazon associates each recording with its respective account. Amazon also plans to expand Alexa beyond the Echo device. Alexa is already available with a smart refrigerator and in certain Ford cars. With Amazon's Key service, strangers are admitted into homes through remote access. Although Amazon assures its customers that video would be continuously recorded and that this unlocking would occur only after proper verification, it remains a potential security risk. A Gartner study in 2015 estimated that there will be more than 20 billion devices connected to the Internet of Things, of which 13.5 billion would belong to the consumer sector. ***While these would be more potential sources of data for these firms to***

gather insights, they could also be more breaches to one's privacy.

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