

# Industry 4.0 Transforming Global Retail Industry

\* *Mercia Selva Malar*

## Abstract

Industry 4.0 is the term used for the current trend of automation and data exchange in manufacturing and the related supportive services technologies. Retail industry across the globe is embracing change in practices as presented and thrust by Industry 4.0. Today we hear of Retail 4.0 as a result of Industry 4.0's influence on the practices of retail. Retail concepts have been influenced and transformed in terms of terminology and processes used for the basic components of retail, store spaces, logistics, and services extended by retailers.

The paper is an attempt to examine how each aspect of Industry 4.0 has transformed the fundamental functioning of the retail industry. The study is an exploratory research based on published material on Industry 4.0 and retail industry.

**Key Words:** Industry 4.0, retail, retail industry

## I. INTRODUCTION

Industry 4.0 is sweeping across the globe and industries. No industry is exempt from the impact of Industry 4.0. Retail industry has also experienced the influence of Industry 4.0 in all its spheres. It is seen and experienced, retail industry being transformed over the recent years with the Industry 4.0 based changes happening in retail practices.

Industry 4.0 is transforming retail industry in the realm of consumer categories, store categories, logistics, and store services. This study has tried to trace the components of Industry 4.0 and the transformation seen in the retail industry. The study is based on literature review and secondary data. The study has tried to compile the various retail applications of Industry 4.0 as seen from articles and news. The application of Industry 4.0 is examined and brought out with the real time practitioners of Industry 4.0.

## II. UNDERSTANDING INDUSTRY 4.0

Industry 4.0 is the term used for the current trend of automation and data exchange in manufacturing and the related supportive services technologies (Forbes Technology Council, 2018). The term originated from a project of the German government in 2011 and is commonly referred to as the *Fourth Industrial*

*Revolution*'. In his book *The Fourth Industrial Revolution*, Professor Klaus Schwab describes how this fourth revolution drastically improves the efficiency of business. Smart factories and cognitive logistics of the future will be employing emerging technology breakthroughs like nanotechnology, quantum computing, robotics, artificial intelligence, biotechnology, internet of things, 3D Printing, Autonomous Vehicles etc. [1].

## III. UNDERSTANDING RETAIL INDUSTRY

Retail industry is the set of firms who serve the ultimate consumers of products or services. Retail industry is predominantly seen in two forms: organized and unorganized retail industry. The retail industry was valued at USD 23,460 billion in 2017 and is expected to register a CAGR of 5.3% during the forecast period (2018 - 2023), to reach USD 31,880.8 billion by 2023 [2]. Internet retailing seems to be way of shopping for the younger generation. Today we have brick and mortar retails along with virtual stores. Online retailers are capturing the market and becoming huge players with their reduction in operation costs. Technology is applicable in every step of retail from sourcing of goods to sale and after sale follow-up. Technology is a great

---

Manuscript received November 10, 2018; revised December 10, 2018; accepted December 12, 2018. Date of publication January 6, 2019.

\* M. S. Malar is Associate Professor with Department of Accounting and Finance at XIME, Kinfra Hi-Tech Park, Off HMT Rd, HMT PO, Kalamassery, Kochi, Kerala, India - 683503. (email: mercia@xime.org)

DOI:10.17010/ijcs/2019/v4/i1/142414

enhancer and transformer of retail industry. Over the past decades and centuries retail industry has been transformed through technological advancements in transportation and communication. Today's e-commerce is a transformation that happened to retail industry as a result of the advancement in communication. With technology evolving and taking new shape as Technology 4.0, retail industry is also being transformed [3].

## **IV. INDUSTRY 4.0 AND RETAIL INDUSTRY**

Totally fourteen components of Industry 4.0 have been identified by the author which are influencing the retail industry. The fourteen components of Industry 4.0 discussed in the article are: Data Analytics, Artificial Intelligence (AI), Internet of Things (IoT), Anticipatory Logistics, Augmented Reality, Virtual Reality, Mixed Reality, Location Tracking, Quality Tracking, Drones, 5G Technology, Smart Lockers, Autonomous Vehicles, Hyper Loops, Automated Warehousing, 3D Printing, Wearable Technology, Humanoid Robots, Digital Retailers, Block Chain Technology, Reverse Logistics and Smart Factories etc. Industry 4.0 is a natural outgrowth of the third industrial revolution, which fully transformed the nature of commerce in the second half of the 20th century with an array of computerization and IT advances. It was a period of big changes for retail and consumer goods companies, marked by the emergence of credit cards, back-office and warehouse automation, just-in-time supply chains, and the first online business models [4]. The various components of Industry 4.0 are detailed in the following part along with their influence on retail industry.

### **A. Data Analytics**

Data Analytics involves the use of technical tools such as Tableau Public, OpenRefine, KNIME, RapidMiner, Google Fusion Tables, NodeXL, Wolfram Alpha, Google Search Operators, etc. as well as data analysis techniques [5]. Various analytics tools are applied to the retail industry. For large retail chains, analytics helps to connect inventories of shops and reduce out of stock situations. The analytics tools can gauge customer requirements, preferences, and tastes of customers, right segmentation of the markets, etc. It is widely employed by almost all retail firms to be competitive in the market and provide customer satisfaction.

Walmart is seen as a leader in many industries, Walmart is also a leader when it comes to big data analytics. As the volume of data continues to pile up, Walmart continues to use it to its advantage, analyzing each aspect of the store to gain a real-time view of workflow across each store worldwide. In every department of the mega corporation, data analytics influence day-to-day operations. Over time, this influences key policy decisions, along with profits. From pharmacy efficiency to product assortment and supply chain management, Walmart continues to set the mark with its robust collection of data.” Walmart uses data analytics specifically in five ways:

- ❖ To make Walmart pharmacies more efficient.
- ❖ To improve store checkout.
- ❖ To manage the supply chain.
- ❖ To optimize product assortment.
- ❖ To personalize shopping experience.

### **B. Artificial Intelligence (AI)**

Almost all retail giants across the globe are utilizing AI and ML tools for targeted advertising, credit modeling, customer need gauging, marketing research etc. Artificial Intelligence products called chat-bots speak to customers, write press releases, and make short films to augment advertisement effectiveness.

Walmart, for example, recently collaborated with Google to offer hundreds of thousands of items through voice shopping by using Google Assistant. This increased level of automation will raise the bar for brands to encourage consumers to break habits and switch products based on voice-activated preferences. Macy has launched a new mobile app that uses AI to help customers navigate through the store. Powered by IBM Watson, the tool enables shoppers to answer questions for themselves so sales associates are free to handle requests that are more complex. AI will go so much farther than just in-store or online. It will take data delivered from the sector and drive product development and even Retail 4.0 innovation based on its learnings.

### **C. Internet of Things (IoT)**

Easy tracking of product movements, delivery, and even consumption by smart labels are easily possible with IOT enabled devices [6]. Diageo is experimenting with an IOT smart label that knows when a bottle is closed or opened, so that they can interact with loyal customers for repeat purchases. Samsung's new smart refrigerators will enable home users to place shopping

orders automatically based on inventory levels.

Amazon has taken the lead with this new breed of retail stores. Amazon has been testing the Amazon Go concept for the past year which enables shoppers to walk into the store, grab a product, and walk out without waiting in line to pay a cashier. Instead, the purchase would be automatically charged to their Amazon account by utilizing sensors, cameras, and other related technologies. The concept further highlights how retail is changing and the necessary steps companies are taking to ensure that retail will survive. After working out some technical bugs, the mega retailer is almost ready to launch the store to the public, according to Bloomberg. According to a new research report by Global Market Insights Inc., IoT in the retail market is predicted to reach over \$30 billion by 2024 [7]. HubSpot presents several ways IOT is changing retail in 2018 as: automated checkout, personalized discounts, smart shelves, in-store layout, optimization, robot employees, optimized supply chain management etc. [8].

#### **D. Anticipatory Logistics**

Anticipatory logistics concentrates on the wholesale and tactical (brigade and below levels), which is a small slice of the supply chain that culminates with the customer [9]. With anticipatory logistics, demand is forecasted from the intelligence collected through sensors and self-learning logistics processes. Walmart and Amazon are already deploying anticipatory logistics in understanding volume and timing of shipping, inventory suggestions and movements across the supply chain. Powered by big data and predictive algorithms, anticipatory logistics means providers can work leaner by predicting consumer demand before an order is made, making delivery times faster, increasing capacity, and boosting the efficiency of networks. This creates an interesting long-term prospect – logistics could ultimately become a data-centric industry, where the data becomes more important than the ability to move cargo [10].

#### **E. Augmented Reality**

Augmented reality products like Microsoft HoloLens helps logistics personnel to decrease picking errors in warehouses and to provide parking instructions to drivers, leading to faster, and more secure delivery process. “Augmented reality is able to create appealing, entertaining, and practical experiences. It enables users to experience events and accomplish tasks that otherwise

might be difficult or impossible for them to experience or complete. When online shoppers are able to see a product virtually that they have never seen before, they are able to have an experiential consumption experience because augmented reality (AR) is an experiential and interactive media that enables users to see and experience shopping without actually being in a brick and mortar store. It creates a simulated shopping atmosphere, just as if customers were in an actual store, and online shoppers enjoy this simulated shopping experience.”(Poushneh, 2018).IKEA's app allows shoppers to place digital furniture and other products from the catalog in pictures of their rooms at home [11].

For example, installing the magic mirror in fashion retail stores help shoppers to virtually try an outfit and experience how it looks on them. With augmented reality, customers will not only entertain shoppers but will encourage them to stay longer in the shop. Augmented reality of high quality is expected to improve store traffic. If interactive, it will entertain shoppers. AR simplifies shopping experience as customers can refer through their mobiles for promotions and coupons.

#### **F. Virtual Reality and Mixed Reality**

During 2017, 35.6 million Americans used voice assistants at least once a month which is 129.9 % growth over the previous year. Mixed reality is the combination of virtual reality and augmented reality technologies, which are very useful in the actual market. Virtual product prototypes can collect feedback from customers and best next generation products can be launched quickly. The combined effect of virtual reality and augmented reality technologies will contribute substantially to the triple bottom line of retail firms.

Retailers are increasingly exploring the virtual shopping experience and the use of mixed reality in store. One exciting application is the virtual mirror, where shoppers can scroll through outfits and see them on their reflections without actually putting the dress or top over their heads.

Virtual dressing rooms are already in use at retailers such as GAP [12]. At the beginning of 2017, the company launched the Dressing Room app, which uses a virtual 3D model to enable customers to see how a piece of clothing would fit based on information such as height and weight. By utilizing augmented reality, the app lets customers try on clothes virtually and order them right from the app.



### **G. Location Tracking**

Real time information on location of vehicles carrying products is possible with the help of electronic sensors fitted in the vehicles and Global Positioning System (GPS). Vehicle Telematics is gaining popularity among fleet owners all over the world. Harnessing location data to distill business insights is a methodology called location intelligence (LI), and it demonstrates that the retail industry is just scratching the surface of what is possible with location-specific analysis [16]. Three specific applications of location tracking are: site planning, indoor mapping, and geomarketing [13].

### **H. Quality Tracking**

Online tracking of quality is required essentially in certain contexts. For example, temperature sensitive products like ice creams, marine products, dairy products, medicines, and volatile items etc. can be damaged if thermostats and related temperature control systems fail. If sensors which can detect and communicate the undesired variation in temperature are placed in the transport vehicles, then the information can be communicated online using GPS.

Nimble Wireless, a Chennai based company has developed such a monitoring system based on Internet of Things (IoT) for cold storage industry. They have over 1200 customers in the US and Canada. The fact that nearly 25% of temperature sensitive products are wasted due to improper storage and handling underlines the relevance of such technologies.

### **I. Drones**

Drones can be helpful in easy and quick delivery of goods without causing traffic congestion on roads. The delivery is not affected by traffic problems also. Drones are simple and cheap to operate, as they are unmanned. Personalized service is also possible with drones. Drone-enabled commerce is widely used by Amazon, Zipline etc. Age Steel in UAE is using a drone technology developed by Exponent Technology Services for tracking inventory. Indian logistics companies like Sendit, Rivigo, etc. are also utilizing drone technologies. US's largest internet retailer Amazon or Global e-commerce giant Alibaba, all are turning their interest in the usage of drones in business [14].

Convenience store chain 7-Eleven was the first to successfully complete a Federal Aviation Administration approved drone delivery in July 2015. The retailer partnered with drone operator Flirtey to make the

delivery, bringing doughnuts, coffee, a Slurpee and chicken salad to a family in Reno, Nevada, within a few minutes [18]. Apart from delivery, drones are also expected to support stock and inventory process where people can't have access like high stacked items and also act as securities, more powerful and smarter than human securities in retail industry [15].

### **J. 5G Technology**

5G, the next level of mobile network infrastructure technology will facilitate faster communication between people and things. Autonomous vehicles can run safely only with the high speed of data transfer offered by 5G eliminating the need for drivers. Millions of drivers will face unemployment but the bottom line of retail firms are expected to improve. 5G is expected to be the platform for big advances in technologies such as artificial intelligence, IoT, robotics, connected cities, and self-driving cars. 5G will enable many applications that cannot be imagined today. 5G will have a massive impact on consumers with faster speeds, greater capacity, and lower latency of this network being its headline benefits [17].

### **K. Smart Lockers**

By installing smart lockers outside the premises of homes and offices, e-tailers can ensure delivery even in the absence of recipients at home. Smart lockers are like letterboxes, which are password controlled so that only the owner and authorized delivery boys can open them.

### **L. Autonomous Vehicles**

Driverless vehicles can reduce workforce for logistic operations. Mining Company Rio Tinto is running 69 driverless trucks at its mines in Pilbara, Western Australia, which are controlled from Perth 1200 km away. For a moving vehicle, a split second delay in braking can lead to serious accidents. Hence, fast communication technology with speed of 5G technology has to be in place, to employ autonomous vehicles for commercial applications like retailing. Autonomous vehicles can improve the delivery time of goods to consumers as the wait time for drivers and allocation of drivers may delay the driver based vehicles.

### **M. Hyperloops**

Hyperloop uses vacuum tubes and linear induction motors for movement of people and products at a speed

more than 1100 kmph. This will reduce lead-time and energy costs. Less energy implies less damage to the environment. Hyperloops are expected to be commissioned between Los Angeles and San Francisco as well as Mumbai and Pune in a few years. Russian Direct Investment Fund (RDIF) has already initiated investment to ship cargo across Russia using Hyperloop technology.

#### **N. Automated Warehousing**

Fast and accurate storage and retrieval systems supported by augmented and virtual reality enabled picking systems and learning systems are available in the modern automated warehouses.

#### **O. 3D Printing**

Technically, 3D Printing is known as *Additive Manufacturing*. Many products can be 3D printed by users. Hence, only raw material needs to be supplied, which would eliminate many of the logistics activities. Customized products can be easily manufactured and supplied quickly to enhance customer satisfaction.

#### **P. Wearable Technology**

Wearables will be able to collect and feed numerous data from users to retailers. For example, data on shopping frequency, basket size, value per item, length of stay, common dwell timings, personality traits, etc. This will help retailers in pre-purchase research, in-store behavior, re-design of store layout etc. Wearables can disrupt the traditional mobile payment mechanisms. Apple's entry into the payment space with Apple Pay on the Apple watch is an example of this. Line-of-right wearable like Epson Moverio, Microsoft Holo lens will provide customers with an improved visual experience inside the store. Facility for effective communication between employees in the retail stores through their wearables will improve their speed and efficiency of operations.

#### **Q. Humanoid Robots**

Automation of front office operations by humanoid robots is catching up. 'Pepper' the humanoid robot developed by Soft Bank Robotics is used worldwide to provide hyper-personalized services. 'Pepper' greets customers, serves them, chats with them, and takes selfies with them. It has been tested in 140 shops in Japan. Many of the shops in California have also

deployed them. Henn-na hotel in Japan is another example of this. In India, some branches of banks are deploying humanoid robots in their reception areas to greet and serve visitors.

#### **R. Digital Retailers**

For retailing of media products like software, music, designs, consultancy packages, etc. digital supply chain management is very convenient. This reduces time, cost, and distance for delivery of media products as distance is irrelevant for this mode of delivery. As the logistics costs are very less, retailers' margin can be kept at maximum level.

#### **S. Block Chain Technology**

With blockchain based distributed electronic ledgers, both manufacturers and retailers can all be looking at the same digital and physical products information in the supply chain. This enables them to cut steps in the shipping and payment reconciliation process. Many international shipping companies like Maersk are using it after replacing the age-old technology of Electronic Data Interchange (EDI). They are joining hands with IBM to provide blockchain technology for use in movement of goods, across borders, and trading zones.

#### **T. Reverse Logistics ad Smart Factories**

In smart factories, quality checking is done for all the items online. Hence, chances of defective product shipping and call back are minimized, making retail business management easier. As the number of defective products reduces, customer delight and brand loyalty also get enhanced.

## **V. CONCLUSION**

Retail industry has been slowly and steadily getting impacted and transformed by Industry 4.0. The transformation of the industry is more in favor of customers who want quick delivery, cost reduction, instant gratification, easy access, etc. Each of the twenty Industry 4.0 aspects have more than one way of benefitting customers. The benefits to customers are automatically translated to benefit for shareholders and other stakeholders. Industry 4.0 can be seen as a boon to retail industry.

## REFERENCES

- [1] K. Schwab, "The fourth industrial revolution," [Online]. Available: <https://luminariaz.files.wordpress.com/2017/11/the-fourth-industrial-revolution-2016-21.pdf>
- [2] Mordor Intell., "Retail industry trends, growth - Segmented by product (food and grocery, apparel, furniture, consumer electronics, personal care, jewellery), type of store (convenience store, specialty retailer, supermarket and hypermarket, internet retailing, discount store), and region - Growth, trends and forecast (2018 - 2023)," *Mordor Intell*, 2018. [Online]. Available: <https://www.mordorintelligence.com/industry-reports/retail-industry>
- [3] G. Finch, "Smart retail and Industry 4.0 – Pushing sales into the future," 2018. [Online]. Available: <https://www.viewsonic.com/library/business/smart-retail>
- [4] PwC, "Industry 4.0: Opportunities and challenges for consumer product and retail companies," *Strategy&*, 2016. [Online]: Available: <https://www.strategyand.pwc.com/media/file/Industry-4-0-RC.pdf>
- [5] N. Wulff, "What's the difference between data analytics and data analysis?", *getsmarter*, 2017. [Online]. Available: <https://www.getsmarter.com/blog/career-advice/difference-data-analytics-data-analysis/>
- [6] D. Mitchell, "5 IoT applications retailers are using today," 2018. [Online]. Available: [https://www.sas.com/en\\_in/insights/articles/big-data/five-iot-applications-retailers-are-using-today.html](https://www.sas.com/en_in/insights/articles/big-data/five-iot-applications-retailers-are-using-today.html)
- [7] D. Maltseva, "The future of retail: How IoT is transforming the retail industry," *Clickz*, 2018. [Online]. Available: <https://www.clickz.com/the-future-of-retail-how-iot-is-transforming-the-retail-industry/214543/>
- [8] C. Forsey, "7 ways IOT is changing retail in 2018," *HubSpot*. [Online]. Available: <https://blog.hubspot.com/marketing/iot-retail>
- [9] J. M. Lenzini, "Anticipatory logistics: The army's answer to supply chain management," *Army Training and Doctrine Command Anal. Center*. [Online]. Available: <http://www.almc.army.mil/alog/issues/sepoct02/ms774.htm>
- [10] Paul Trudgian Ltd., "Get ready for logistics disruption in 2018 and beyond," 2018. [Online]. Available: <https://www.paultrudgian.co.uk/logistics-disruption-2018-beyond/>
- [11] K. Klamann and S. Kraster, "Why AR will be the next revolution in retail?" *Strategy + Bus.*, no. 87, 2017. [Online]. Available: <https://www.strategy-business.com/article/Why-Augmented-Reality-Will-Be-the-Next-Revolution-in-Retail?gko=dbc10>
- [12] L. Nunan, "Gap tests new virtual dressing roomapp," *Gap Inc.*, 2017. [Online]. Available: <https://corporate.gapinc.com/en-us/articles/2017/01/gap-tests-new-virtual-dressing-room>
- [13] T. Costa, "How location analytics will transform retail," *Harvard Bus. Rev.*, 2014. [Online]. Available: <https://hbr.org/2014/03/how-location-analytics-will-transform-retail>
- [14] K. Shukla, "How drones are changing the face of retail sector?," *Geospatial World*, 2018. [Online]. Available: <https://www.geospatialworld.net/blogs/how-drones-are-changing-the-face-of-retail-sector/>
- [15] S. Farner, "How drones will change the retail industry?" *Disruptor*, 2017. [Online]. Available: <https://www.disruptordaily.com/drones-will-change-retail-industry/>
- [16] J. Torre, "How location data can revolutionize retail," *TotalRetail*, 2017. [Online]. Available: <https://www.mytotalretail.com/article/how-location-data-can-revolutionize-retail/>
- [17] L. Barnes, "The generation game: The impact 5G will have on retail, storage, smart cities and more," *PCR*, 2018. [Online]. Available: <https://www.pcr-online.biz/features/the-generation-game-the-impact-5g-will-have-on-retail-storage-smart-cities-and-more>
- [18] C. Williams, "Future of retail: Drones to play a big role in the next 10 to 20 years," 2017. [Online]. Available: <https://www.forbes.com/sites/bisnow/2017/07/06/future-of-retail-drones-to-play-a-big-role-in-the-next-10-to-20-years/#429b792a3eb2>

### About the Author



**Mercia Selva Malar** is Associate Professor with Department of Accounting and Finance at XIME, Kochi.