**Algorithmic Retailing – Implications of AI and Machine Learning in Retailing world**

Dr. Seranmadevi R, Associate Professor,

Department of Professional Studies, Christ University, Bangalore, Karnataka, India

Email: seranamadevi@gmail.com

***Abstract***

*Algorithmic retailing is mess terminology for the normal retailers, but the electronic commerce retailers already having the experience of technology-based retailing seek it as a notorious opportunity to equip their level of operations with due diligence. The advent of technology and the diffusion of the same in the retailing world will be evidenced through a lot more opportunities to engrave the retailing operations beneficial to retailers and customers. This study is an attempt to explore the implications of Artificial intelligence and machine learning algorithms in the retailing world through the cosmetic term called “Algorithmic Retailing”. The extent of changes effected by these technologies in the retailing operations, the changing paradigm of the functionality of retailing, the benefits of applying the technologies in leveraging the retailing transactions and delivering the immerse experience to the consumer, and the challenges ahead therein. It is concluded that the continuous seamless involvement of technology will raise the retailing industry to a higher standardized performing industry, with an alarm of careful screening of diffusion on technology.*

**Keywords:** Algorithmic Retailing, Artificial Intelligence, Deep Learning, Machine Learning, Retailing

**Introduction to the study**

Ever evolving consumer base demands the retailing industry to equip itself and transform rapidly, robustly, and dynamically with vibrant technology advancements. Algorithmic retailing is a form of transformation happening in the retail world in terms of all its activities starting from merchandise management to customer retention. Algorithmic retailing is leveraging the functions of the retailing industry in a never imaginable way. The diffusion of technology is developing the algorithm for every activity of retailing to the pre-programmed decision unit. The merchandise management is efficiently handled by evaluating the historical data of the consumer after due considering the trend and cultural changes happening in the environment. Irrespective of the field, in all ways the technology has taken the complete benefits of automizing the retailing operations. It improves the time efficiency, cost efficiency, and consumer efficiency as a whole the complete efficiency of retailing.

**Background of the study**

It is a fact becomes the data and processed information will be made available to handle critical scenarios to hope up with an appropriate decision. The data world is emerging as a database, data warehouse, data mining, and data mart, now with the voluminous data storage as Big Data. In retailing, every transaction fires at the front as well as the back end conveying data. If this data is not used properly to evaluate and execute in the dynamic present environment, then the accumulation of data is of no use. The big data alone cannot perform anything, it needs to be aligned with any other technology like Artificial intelligence, machine learning algorithms both supervised and unsupervised, neuro networks, predictive analytics, if-then-else, what-if analytics, and so on to equip the data to contribute towards the future success. These technologies have used the historical and present data observed in the retailing industry to perform the task concurrent to the present situation based on certain constraints and used to predict well-in-advance the demand level, seasonal variation and consumer focus, trend changes, and behavioral variations. Dynamic algorithms are placed strategically open doors of opportunity in the accumulated unstructured big data to channel the right information at the right time. Big data alone does not possess the ability to interpret information to find insights. Thus, the retail scenario is employing algorithms and machine learning to get the insights to stay ahead in the market.

This wave of “Algorithmic Retailing” is powered by Artificial intelligence (AI) and Machine learning (ML), which are enabling machines to acquire cognitive capabilities hitherto exclusive to humans: natural language processing, pattern recognition, and the ability to hypothesize and learn with experience as rightly pointed out by Rajashree, Global Head of Retail Strategic Initiatives, Tata Consultancy Services.

**Statement of the problem**

Transformation is permanent, change is everywhere present, and retailing is not an exception to that. The retailing industry undergoes different phases of its evolution over some time due to multiple factors and influences, but now the credit goes to the technology diffusion under the digital era. This change and transformation are always a credible and positive move in retailing which is solicited by both the retailers and consumers. The technology leverages the functions, duties, and contingencies of retailing and assists the stakeholders of retailing to experience a higher-end quality of life in the retailing industry. Now, it is the need of -the the-day, to study the practical implications of technology diffusion in retailing amidst huge investment in technology. This study is an attempt to underline the graceful applications of technology and its drawbacks hitherto.

**Research questions**

The retailing industry is considered to be the ever-green industry in the world. Where even a single consumer is found, there exists retailing. The evolution of retailing is robust and it is witnessed by the technological implications often. The advent of technology such as Artificial intelligence and machine learning algorithms are reframing, and restructuring the modus-operandi of retailing business in the digital era. Now, the question formed here is to what extent the implications of this technology transform the retail industry? To answer this question, the following objectives are developed.

**Research Objectives**

The following are the research objectives assumed to execute the study,

* To study the implications of Artificial Intelligence and machine learning technology in Retailing
* To understand the reengineering areas of retailing
* To evaluate the benefits and challenges of algorithmic retailing

**Research Boundaries**

This research is focused only on retailing industry and the changes effected by Artificial intelligence and machine learning technology in the retailing industry. The research narrates the benefits and uses of the implication of these advent technologies and the challenges ahead therein.

**Research framework**

The study implies the conceptual framework of explaining the extensive implications of AI and ML in retailing and the same was depicted in the following flow chart,

Artificial Intelligence

Machine Learning

Image Processing

Reordering Inventory

Merchandise management

Assortment Collection

Refilling Inventory

Space utilization

Planogram & shelf usage

Seasonal variations

Prediction on consumer behaviour

Efficiency in Retailing

**Research Scope**

This study is evaluating the implications of artificial intelligence and machine learning in the retailing world. It attempts to portray the extent of use of artificial intelligence and machine learning algorithm in discharging various retailing functions like assortment collection, arrangement of planograms, automatic refilling of merchandise, auto-ordering of inventory, and space matrix in the shelf, predicting consumer behavior, and demand forecasting, etc. This study focuses on the deployment of AI and ML technologies and their benefits and challenges derived thereof.

**Research Methodology**

The research design adopted for this study is the exploratory research design. It is an attempt to explore the invasion of artificial intelligence and machine learning technology in the world of retailing. It is an upcoming trend in retailing, the advancement in technology leveraging the pressure of retailing industry to a certain extent. The careful analysis and implementation of this advanced technology will solicit a lot of unimaginable changes in the retailing world. Whereas it has the other end as well, the non-compliance of certain procedures and lethargic treatment of technology will injure a lot, driving the company away from the industry. It is exploring only the usage, benefits, and challenges encountered by the retailing companies due to the incumbent effect of Artificial Intelligence and machine learning technology.

**Research Implications**

The need for algorithmic retailing is growing with the times as the competition increases and the average customers’ preferences change quickly with technology penetration and increasing options. The trend is propelling businesses like grocery and staples to big fashion brands, to apply algorithms in numerous ways to make faster business decisions in the following field of retailing

**Inventory Management -** Predictive analytics in retail is an algorithm applied to predict future market demands and fluctuations. This helps in stocking up the right products according to the situation that would help generate more business.

**In-Store Allocation -** Applying algorithms to big data will help in building intelligent predictive models that would equip the retailing industry with the knowledge found from unstructured data, collected from various sources like social mentions, buyer history, preferences, etc. which can measure the footsteps of the customers.

**Store Display -** Applying algorithms in retail to analyze and forecast the trends informs the store managers about how to strategize their store and window display. It also increases the brand value as it positions the company among the trendsetters being up to date within the industry.

**Channel Optimization -** Connecting the dots for IoT is algorithmic retailing. For smartphone-yielding, app and website-friendly customers, channel optimization for a retailer is a must. Comparing inventory availability and in-store stock, calculating expected delivery time, infusing online activity with in-store to find similarities and provide instantly redeemable offers, algorithmic retailing is doing it all behind the scenes.

**Price Optimization -** From optimizing prices depending on the market scenario to market basket analytics, retail hardly has a segment left where algorithms are not at work yielding strong results. Algorithms are being applied to in-store traffic pattern measurement and will continue to explore new territories of retail in the future allowing for better decision making.

In a day, ridiculously 2.5 million-plus price changes effected in retail by Amazon alone; Leading researchers/industry heads have not only called this trend fair, but also an inevitable paradigm shift, commanding market players to notch up their game and deploy price intelligence to stay afloat among stifling competition, thinning margins, and hard-to-please customers.

**Targeted Marketing -** By placing algorithms online and by static reports retailers can find out characteristics of longer lifetime value customers and curate offers catering to their needs and bringing better value to the business. It can be provided real-time recommendations based on browsing activity and send activity-based recommendation texts and emails and provide advertisements on social media as well.

**Geo-Fencing -** To ensure when an existing or potential customer walks in the fenced area within the proximity zone of the retailers, then the retailers can able to send curated messages to the consumer. Even the retailers offer coupons and e-receipts via message to encourage the customer to spend more time in the store.

The factors which get influenced by algorithmic retailing are,

* Dynamic inventory optimization
* Enhanced space optimization through routing and scheduling algorithm
* Planogram compliance
* Automating store tasks
* Gap scanning on Shelf
* Selecting the optimal route for picking
* Detecting anomalies to predict and solve in omnichannel customer journeys
* Contextual personalization
* Fulfilling the customer promise through last mile visibility, and
* Customer flow path optimization

**Challenges of Algorithmic Retailing**

Amidst all the transformations registered in the retail industry, it needs to reconsider a lot of sensitive platforms where the retailing needs to have surveillance over it. The problematic area identified when diffusing the technology in the retail world are,

* varying instore illumination levels,
* product packaging patterns,
* surface and styles;
* frequently changing product packaging;
* multiple product orientations on shelves;
* constraining in-store spaces;
* with varying camera resolutions and
* height of store associates, and so on.

It is witnessing a real-time scenario that, often two sellers on Amazon selling the same kind of merchandise compete with each other by changing the price. They use an algorithm that works on relative pricing concerning opponent and demand. Due to the uniqueness of this algorithm working nonstop for the retailer, the price of a commodity changes not just once in a day, but many times based on demand. At one point in time, it was noticed that in 2011 that one of the biology books with an MRP of $20 was being sold on Amazon at a humongous price of 23 million dollars, unimaginable, this is the problem of the algorithm. Perhaps, it is no matter the efficiency of technology, there are always some glitches during the starting stage. The amicable way to go ahead with the algorithm in the retail world is to have a dedicated audit and scrutiny team to ensure the quality technology is diffuse.

**Benefits of Algorithmic Retailing**

The following are the benefits of algorithmic retailed as mentioned by several researchers,

**Scale:** Algorithmic retail establishes a common foundation from which all business units can build AI applications, share data, and cross-leverage outputs.

**Value:** Working from a common platform allows the organization to maximize ROI in the form of improved organizational agility, cross-function collaboration, operational efficiency, and cost savings.

**Speed:** Working from a common platform greatly improves the pace at which the organization can build production models, while also allowing increased experimentation.

**Collaboration:** Apps built on the platform can be integrated, which can help improve overall visibility within the organization and across the global network.

**Efficiency and cost savings:** The cross-function platform eliminates the need for each business unit to duplicate initial project phases, while also streamlining management, maintenance, and operations.

**Conclusion**

Encompassed Technologies with the existing data and algorithms like artificial intelligence (AI), machine learning, Internet of Things (IoT) and Blockchain will transform every single aspect of the business. But it is evidenced that the real transformation in retailing will be recorded only when algorithmic retailing is applied beyond the scope of personalization and customer service, and evolves into other core areas like logistics and supply chain, merchandising management, In-store operations. In the retailing industry, the technology is diffused in such a way as predictive analytics for demand forecasting, unsupervised learning for customer segmentation, reinforcement learning for decision support, and deep learning for image and speech recognition in the retail world, it will give immerse experience to the retailers as well as consumers. This trend clearly shows that algorithm retailing will keep on influencing the market in the future and the dynamically evolving retail market will also have positive effects on the changing economic scenario as both the retailers and the customers become wiser with their elegant choices.

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