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Operations Research in the Retail Industry

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ABSTRACT

The COVID-19 crisis is one of the most disruptive occurrences of the past several decades. Numerous studies in numerous disciplines, including consumer behaviour, have been motivated by its profound effects, necessitating an effort to review and organise the literature. This article provides a broad summary of the retail industry before and after covid. Changes in purchasing behaviours, modes of transportation, the development of retailers and the customers they target as a direct result of big data analytics, and a comparison of pricing policies in place before and after the emergence of covid.

Keywords: Consumer Behaviour, Big Data, Consumption, Covid-19, Perceptions, Literature Review, Purchasing Patterns.

INTRODUCTION

The coronavirus (COVID-19) pandemic destabilised the economy and contributed to changes in purchasing patterns, online transactions, and mental health. COVID-19 is a "sequence of impacts" as it travels from location to location. According to Mathew, India was under lockdown until 31 May 2020, beginning on 25 March 2020, to prevent the spread of COVID-19. It affected the country's economic conditions and was extended until the end of 2021 to control the spread of COVID-19. According to a New Delhi television report, India's GDP decreased to 2.5% from an estimated 5.3% just 10 days before the lockdown was imposed to prevent the spread of COVID-19. According to Mohanty's study, consumers panicked, and their confidence levels decreased. According to the Nielson study (2020), purchases and sales of hand sanitisers, medical masks, and household maintenance masks increased rapidly.

Response to the pandemic may vary based on demographic factors. Will purchase behaviour alter under lockdown conditions or vary according to demographic characteristics? What will the mental state of respondents with different demographic variables be like during lockdown conditions, and how will they adopt technology such as online shopping? According to the fear theory, does fear influence behaviour? This research contributes to the existing marketing and e-commerce literature on COVID-19. Therefore, this study aims to determine the effect of COVID-19 on purchasing behaviour during this time as influenced by various demographic variables. By conducting specialised research in emerging markets, the purpose of the study is to add to our understanding of the changing consumer behaviour under COVID-19. This paper also aims to shed light on the categories of segments typically used during crises under COVID-19 in emerging markets such as India. This study will determine how individuals view government initiatives and their implementation. The lack of research on COVID-19 in emerging markets such as India may be a limitation of the literature review.

This paper's remaining sections are organised as follows: As the COVID-19 pandemic is new, the second section contains a literature review based on limited research. The third section presents the application of theory; a theoretical construct is formulated based on variables identified in the literature review, and hypotheses are developed based on the research questions. The methodology is presented in the fourth section. The fifth section contains two subsections describing the results: descriptive analysis and hypothesis testing. A discussion and validation of the theoretical construct follow the results. The final section concludes the paper with conclusions, limitations, the scope for additional research, and managerial implications. The study's contribution is discussed immediately following the results.

As per a report, India is the fifth-largest and preferred retail destination globally. The country is among the highest in the world in terms of per capita retail store availability. India's retail sector is experiencing exponential growth, with retail development occurring in major cities and metros and tier II and III cities. Healthy economic growth, changing demographic profile, increasing disposable income, urbanisation, and changing consumer tastes and preferences are some factors driving growth in the organised retail market in India.

COVID-19 has messed up everything. Although many industries are experiencing change, retail is experiencing perhaps the most rapid and radical changes of all. Consumer behaviour and technology create an environment driven by online transactions and heightened expectations. Because in effect, with the pandemic, more people have learnt to order stuff online, which has made them anything but lazy and wanting everything at their doorstep without getting out of their comfort zone, and this is not going to go away immediately; instead, it is only going to stay if not increase. Growth will be slow initially but ramp up quickly.

Consumers are more conscious of their purchases. They attempt to reduce food waste, shop more economically, and purchase more sustainable products. This will need to be an integral part of a brand's offering (e.g. by exploring new business models). Because the consumer under lockdown has discovered an alternative that is more convenient, affordable, and accessible, some habits will inevitably die. Examples include Netflix and Disney streaming services. They will likely displace consumers from movie theatres.

With lockdown and social distancing, consumers have limited options for where to shop. This has led to location restrictions and a shortage of available locations. There is a mobility shift and a mobility deficit. Work, education, and shopping have all relocated to the home.

1. Hoarding. Consumers are stockpiling daily consumption necessities, resulting in temporary stock-outs and shortages. This includes toilet paper, bread, water, meat, and cleaning and disinfecting supplies.

2. Pent-up Demand. The general tendency during times of crisis and uncertainty is to delay the purchase and consumption of discretionary goods and services. This is commonly associated with high-priced durable goods like automobiles, homes, and appliances. It also comprises services such as concerts, sports, bars, and restaurants.

MENTAL STATE OF CONSUMERS DURING COVID-19

People demonstrate greater fear and anxiety when they perceive pandemic threats as more severe or detrimental—increased tension, panic, anger, pessimism, and helplessness. This could result from unsafe distances, masks, or population density. It increases the likelihood of contact with infected neighbours. Anxiety, mental disorders, and fear all result in protective behaviour.

According to Manabe et al., H5N1 patients in nearby areas can exacerbate panic. The media explain the prevalence and nature of pandemics, prompting citizens to seek additional information. Fear is a common characteristic of pandemics, so consumers may exhibit similar behaviours. Due to the coronavirus infection, consumers' anxiety, fear, and purchasing behaviour are altered by COVID-19.

IMPACT OF COVID-19 ON CONSUMER BEHAVIOUR

Many consumers who are not accustomed to lockdown conditions have experienced anxiety due to COVID-19 restrictions. Therefore, it is essential to comprehend the mental state of consumers, as it influences their behaviour. According to Clement et al., "fear appeal is associated with a rise in online purchases. During an epidemic and its quarantine period, it is important to keep people calm and focused. According to Li et al., "negative emotions (such as anxiety, depression, and indignation) and sensitivity to social risks" are associated with lower levels of satisfaction among COVID-19 participants. Consumers' concern for their health increased. Due to the lack of similar research, it will be interesting to study Indian consumers in emerging markets like India during a pandemic.

EVOLUTION OF RETAIL POST COVID-19

The Evolution of Retail in India includes different factors like- generations, technology, wants & convenience. If we look at the past behaviours of consumers, people used to believe in physical stores and the touch & feel of the product. Nevertheless, Covid 19 has changed people's shopping choices from retailers. Initially, it was mainly because of the situation and the safety purpose, but if we compare the post-Covid scenario, the options look out for convenience now. Online retail has taken over a vast sector of offline retail competitors.

Although there has been much progress to date, the role of physical stores is still essential despite the rise of online retail. Generations play a significant role in making decisions.

Generation X and Millennials are still the leading believers of offline stores. Technological advancement has changed many decisions, but 20% - 30% of people still go for offline retailers, whether buying groceries from Kirana stores or buying insurance.

GENERAL PURCHASING BEHAVIOUR OF CONSUMERS

E-commerce has been expanding in India for the past decade now. Customers prefer to buy products at lower rates the e-commerce platforms. For example, people prefer ordering stuff of a particular brand from Amazon at a cheaper rate with free delivery service rather than buying them at the market price from their offline stores. The element of attention here is the Cash on delivery option, which is more important to the customer to evaluate their buying decision, mainly the post-purchase decision.

Retailers are leveraging more on digital retail channels, which helps them cut costs on real estate and enables them to reach more tier 2 and 3 cities.

The online retail market in India is projected to reach US\$ 350 billion by 2030 from an estimated US\$ 55 billion in 2021 due to rising online shoppers in the country. Online retail penetration is expected to reach 10.7% by 2024 versus 4.7% in 2019. Many businesses have already adopted the new technologies because as the generations move, mainly the Millennials and Gen Z consumers are more tech-savvy than the older generations, as they have access to all the digital technologies and information. So, they are more likely to adopt the digitalisation era.

For example, in the past, when people had to buy a pair of spectacles, they would go to their nearby shop and get options to try different frames and wait for the lenses to be fixed to collect them. However, now online retailers have created a tech where you can see your face wearing a frame at your home, choose from the options and get it delivered to your doorstep. Lens Kart is one of the most successful companies.

However, consumers' resistance to online shopping for lifestyle retail products, driven by a lack of trust, has begun to reduce. Many small businesses have been forced to develop digital platforms to beat the competition.

Not all shops had QR code panels, but almost all retail stores now have QRs for payment. Moving ahead, people find it convenient to make most payments online rather than carrying Cash with them. Also, people have moved from swiping credit cards to tapping them to make payments. So, convenience has been a factor of attraction.

Now people look for superior customer experience and a seamless journey while buying. Omnichannel retailers allow shoppers to transition between physical and virtual stores, ensuring a seamless in-store experience.

For example, Amazon has now opened its first retail clothing store, 'style', where the customer can scan a QR on the tags attached to the clothes and select their size; the selected clothes are transferred to the trial room and bought. Customers can also order the same product online after trying it and getting it delivered home.

Brands have pushed customers to move offline to online by providing them with personalised experiences. Many big businesses have embraced the new social and digital platforms to reach customers. The future will drive more customers to Omni channel retailers. Technology adoption and online buying for this segment are expected to accelerate, mainly led by the young generation over the next decade. Gen Z and Millennials will age, their buying power will be, and they will be recognised as independent shoppers. They will spend more on the lifestyle segment as the retailers cater to the tech-savvy audience.

The COVID-19 pandemic has quickly upset the world's political and economic order, significantly impacting industries that provide consumer services, including retail, hospitality, and tourism. Due to the outbreak, lockdowns on an unprecedentedly massive scale and significant restrictions on daily activity have been imposed worldwide. To address the shifting consumer demands, more consumer services companies are experimenting with new technologies and platforms, resulting in new consumption patterns. Some consumer services companies have created different business models, such as "contactless delivery" and "social cinema," to deal with the limits.

Making a purchase is a unique and particular conduct that directly reflects the desires, goals, and pursuit of the material and spiritual interests of the individual. Social, cultural, demographic, and situational factors are among those that influence changes in purchasing behaviour. As a result, the COVID-19 pandemic is having an impact on various shifts in consumer behaviour. Most academics agree that many consumers engaged in impulsive or panic buying during the early stages of the COVID-19 pandemic, sometimes even accompanied by compulsive shopping. While purchasing behaviour is marked by mobility amid the COVID-19 pandemic. The use of digital technology has made it easier for customers to engage in online purchasing, and their online purchase activity has substantially expanded. The literature mentioned above does not systematically classify the changes in consumer purchase behaviour caused by the COVID-19 pandemic; instead, it focuses on changes in a single dimension. To improve the items of the buy behaviour changes in each size and give supplements for the theory of consumer behaviour, this study carefully sorts out the many dimensions of changes in consumer purchase behaviour during the COVID-19 pandemic.

BIG DATA AND RETAILING STRATEGIES

This change is nothing less than dramatic. This is because investments in Big Data to define and decide corporate strategy has shown a good return on investment (ROI). About 78% of the people who participated in the study said that investing in data analysis for strategy gave them a positive return on their money. This is the highest number for any function or process. This means that retailers will use Big Data and analytics to answer questions like:

Growth: Where are we now in terms of growth? How do we get to our 5-year goal? What should our plan be? What do we need to change in the organisation to reach our goal?

Financials: How can we use data to balance risk and our growth plan? How can we use data to find hidden opportunities to improve how much we spend on advertising?

Customer: How can we use information and data to improve customer experience? How can we provide an omnichannel experience that leads to more sales, better customer service, and more loyal customers?

Store: What can be done to improve inventory, reduce shrinkage, and handle returns while making the most of labour and giving customers a memorable in-store experience using data?

How can we develop new ideas for products, markdowns, accurate replenishment, and seasonal volumes to meet customer needs?

How can we get more value from suppliers, distributors, and channel partners in the supply chain?

Technology: What are the best technologies for predicting business needs so that we can meet our growth goals?

Big Data will become more critical in retail when it starts to affect financial decisions, risk management, diversification, people and resource management, and meeting legal and regulatory requirements.

WHAT ENABLES DATA-DRIVEN RETAIL?

The answer is technology. Retail technology helps businesses leverage data to drive better business outcomes, reduce costs, and increase conversions. Let us look at two innovative technology solutions that turn touchpoint data into actionable retail insights.

Retailers without video analytics should rethink their IT strategy. This technology affects all business KPIs. Every retail store has CCTV cameras that generate daily video or image data that can be analysed. CCTV has moved beyond surveillance and loss prevention. Video analytics solutions can count customer footfalls, understand shopper traffic demographics, create heat maps to understand aisle and product placements, and predict queuing patterns for faster checkouts. These insights improve shopping experiences, store performance, operational costs, and omnichannel presence. During the pandemic, video analytics was used to ensure compliance with COVID guidelines like wearing masks and Social Distancing, which helped shoppers return to offline shopping safely. Biba, Zivame, Lenskart, and Campus Shoes are among the leading Indian retailers implementing video analytics technology. This technology is gaining popularity because it works on existing infrastructure to generate real-time insights without requiring new CAPEX.

AI & ML help retailers build a solid data foundation. Video analytics combined with AI provides deeper intelligence without human intervention. Computer vision is a popular AI technology used in cameras to scan shelves, place products, analyse customer emotions, analyse staff interactions, and count footfalls. Retailers have online and offline customer buying histories. AI models and ML algorithms help them explore all this data quickly and offer personalised shopping experiences, which increases their brand value and customer base. AI in the retail supply chain can predict product demand by analysing sales, location, seasonality, popularity, promotions, and other trends. Facial Recognition, combined with geofencing, is used to manage staff time & attendance and track shop floor time. Most retailers use AI chatbots to improve customer service, promote new products, and suggest similar items. Automated store checkouts and robotic warehouse management are also gaining popularity in India. Cloud technologies and AI-as-a-Service solutions help businesses adopt AI quickly and cost-effectively, making AI/ML use cases accessible to even the smallest retailers.

According to a NASSCOM report, "over 80% of retail enterprises believe existing reskilling talent is key to driving effective AI adoption."

Improving customer experience, reducing costs, and boosting brand loyalty are no longer hit-and-miss activities. To stay ahead of the competition, retailers must embrace a data-driven retail strategy that helps them make informed decisions and remain responsive and agile in a fast-changing landscape. Adopting the right technologies will convert data points at every value chain into valuable insights. Video analytics and AI are Indian retail game-changers.

METHODOLOGY

Study objectives- Criteria for inclusion of articles-Method describing and systematising the literature-bibliometric analysis

Study objectives:

This gives a clear idea of consumer behaviour pre & post covid, consumption patterns, pricing policies and big data analytics strategies, which helps

This objective is broken into the following steps:

- 1. Customer understanding**
- 2. Supply chain management**
- 3. Assortment analytics**
- 4. Demand forecasting and returns management**
- 5. Pricing and marketing strategies**
- 6. social media analytics**

CRITERIA FOR INCLUSION OF ARTICLES

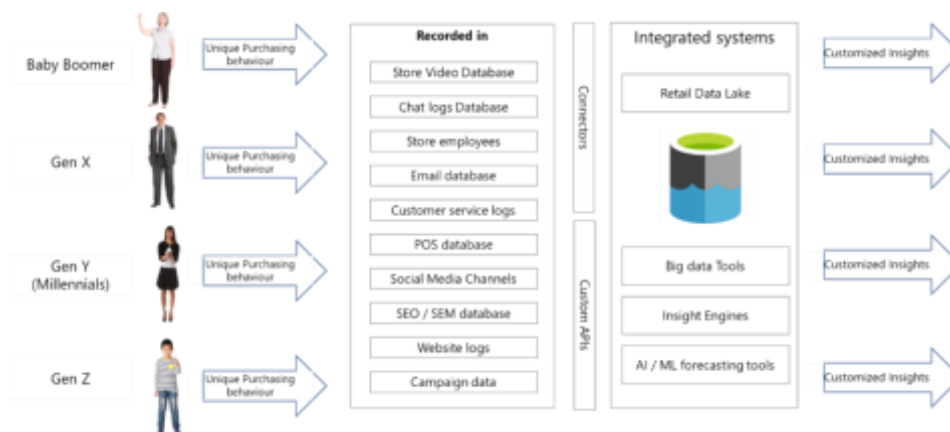
The study developed several article-inclusion criteria. Importantly, studies must address COVID-19 only from the perspective of consumer behaviour. Thus, it was essential to differentiate consumer behaviour from other human behaviour in the COVID-19

framework. Consumer behaviour encompasses people's behaviour in their search, purchase, usage, and disposal of goods and services.

METHOD DESCRIBING AND SYSTEMISING THE LITERATURE:

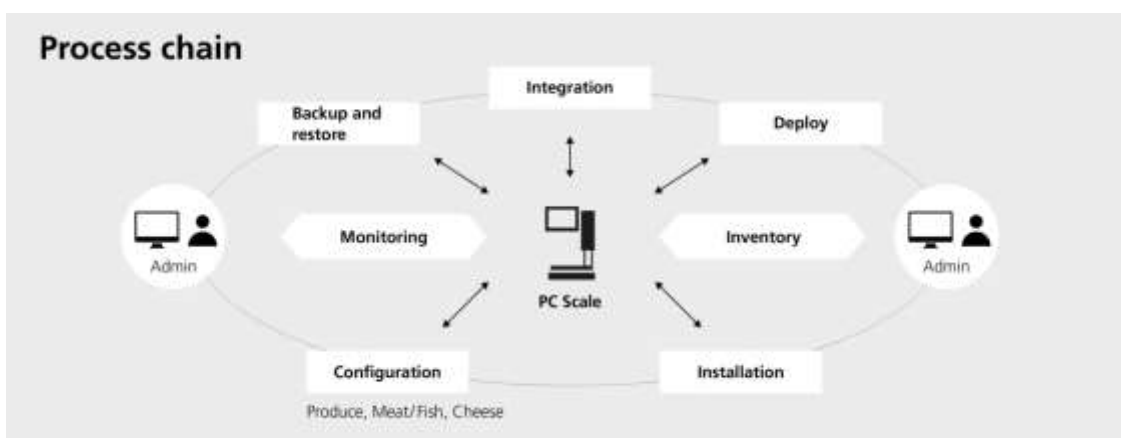
The study employed various bibliometric and literature systematisation techniques to describe the characteristics and interrelationships of the 25 articles and systematise their content. Bibliometric methods estimate the main descriptive statistics of the relevant body of knowledge. Further, a visual analysis of co-occurrence was performed.

The study used content analyses of the generated knowledge and findings to systematise the literature seeking a knowledge organisation structure.



Creating consistent brand experiences across channels, attuned to shifting demand, requires a solid digital foundation. Retail enterprises need information about their existing consumers, target market, and purchasing behaviours to design successful digital strategies and enable technology roadmaps. Economists have classified the consumerist generation into 4 significant categories of ages, Baby boomer gen x, gen y (aka millennials), and gen z. Each generation has had different growth paradigms, technology dependence, and purchasing behaviours.

To customise and market products to every generation of customers in the best way possible, it is imperative to gain customer interaction data and convert it into insights. For most retailers, much of this information lies in multiple disparate systems of record, as shown in the diagram, and it needs to be unified into a single data source for Big data analytics; this can be done leveraging custom APIs, connectors, cloud data lakes, and extensive data systems. Such a unification could proactively, in near real-time, provide insights into changing demand and provide customised insights to create a retail framework that enables fast change, fuels growth, and repositions them from a firm selling goods efficiently to a firm that allows consumers to buy precisely what they want and need, from a retailer they trust. Edge AI and NFC devices combined with other retail technologies are improving the big data gathering and customer insights generating process. These further the use cases for virtual and augmented reality, bright screens, and mobile-cloud services. Furthermore, AI and machine learning could take optimal advantage of social media's growing influencer network.



Retail chains with many scales in different locations must ensure identical configurations, software revisions, and operating procedures. Retail chains can use management software to automate scale installation, configuration, monitoring, and maintenance. All devices can be updated locally without user intervention. Complex installation tasks have low administrative overhead. Automatic failure notification reduces service calls and downtimes and ensures uniform data revisions across devices.

Service technicians can install scale and retail applications remotely. Massive rollouts can now be done quickly and without travel. New rankings are powered on and networked after being unpacked. The software handles all installation steps. An integrated monitoring feature alerts the administrator if installation or configuration fails. Remote maintenance fixes any failures before the store opens, ensuring smooth operation.

LITERATURE REVIEW

Using big data analytics, we analysed situations in the retail industry, consumer consumption patterns, and the evolution of the retailing system over the years using various articles from our college library's online portal. We also ran pre- and post-covid on all of the situations mentioned above.

Operation research is a scientific method of providing executive departments with a quality basis for decisions regarding the operations under their control.

Operational research techniques used in our research paper are:

STIMULATION: A simulation in which one or more real decision-makers perform decision-making is called "operational gaming." Such simulations are commonly used to study decision-makers interactions in competitive situations.

QUEUING THEORY: A queuing problem consists either of determining what facilities to provide or scheduling their use. The cost of providing service and the waiting time of users is minimised. Examples of such problems include determining the number of checkout counters to offer at a supermarket or shopping mall,

3. INVENTORY CONTROL SYSTEMS: It is a complex chain of operations that oversees product storage, replenishment, classification, warehousing, turnover and tracking. Inventory control is a multi-functional and multi-dimensional process.

NETWORK ANALYSIS: A network routing problem involves finding an optimum route between two or more nodes concerning total time, cost, or distance. Various constraints may exist, such as prohibiting returning to a node already visited or stipulating passing through every node only once.

TRANSPORTATION: Transportation was observed while exporting or importing goods to or from a retail store. Through this, the store was able to utilise its resources and manage the cost of transportation.

ASSIGNMENT: The use of terms is seen during staff management. It was observed when the different task was given to each staff member by considering the timings of their shift, the salary they were paid, and the skills they had.

BIBLIOMETRIC ANALYSIS

Analysis of the co-occurrence

The study employed co-occurrence analysis to establish the topics of interest in the articles on COVID-19 and consumer behaviour. The research was performed in two ways to obtain more reliable results: keyword-based and title- and abstract-based.

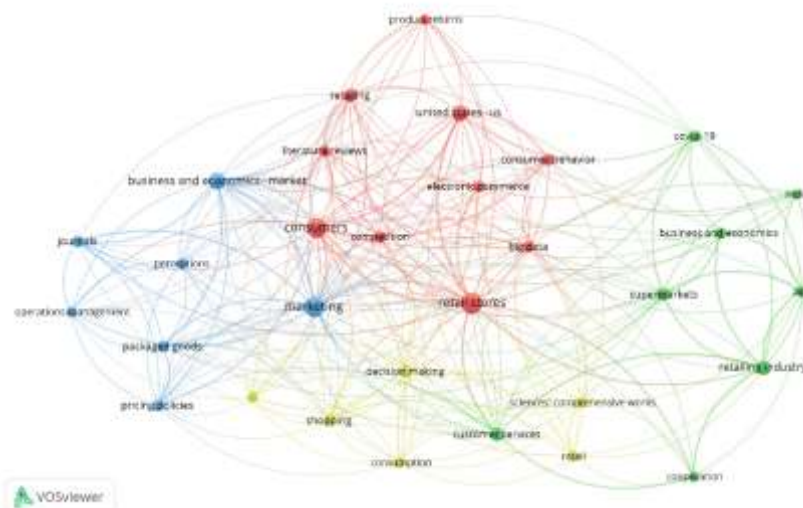
First, we sought to identify the clusters formed based on the co-occurrence of keywords in the articles. We employed VOSviewer 1.6.15 for this analysis.

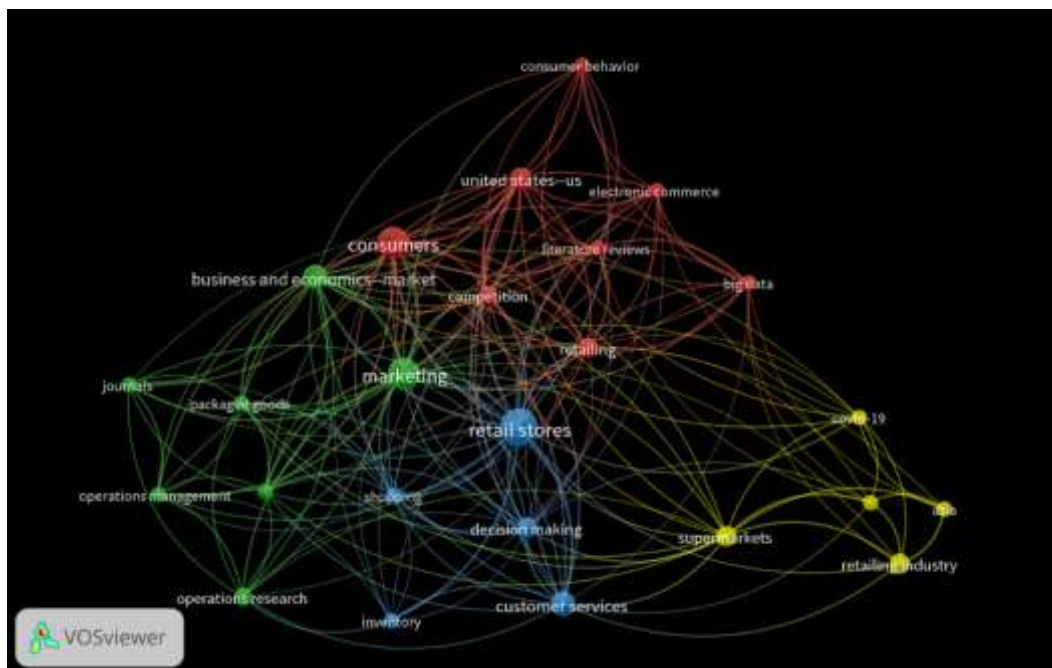
VOSviewer suggests, by default, a minimum number of five occurrences for a term to be considered. However, we set this number to two and four, given the relatively small number of articles. Generic words like "article" and "study" were removed during the data clean-up.

Additionally, similar terms were grouped into a single term

The nodes represent keywords or concepts, while their size corresponds with their frequency. VOSviewer represents each cluster of keywords or images with a different colour.

Analysis with fewer co-occurrences





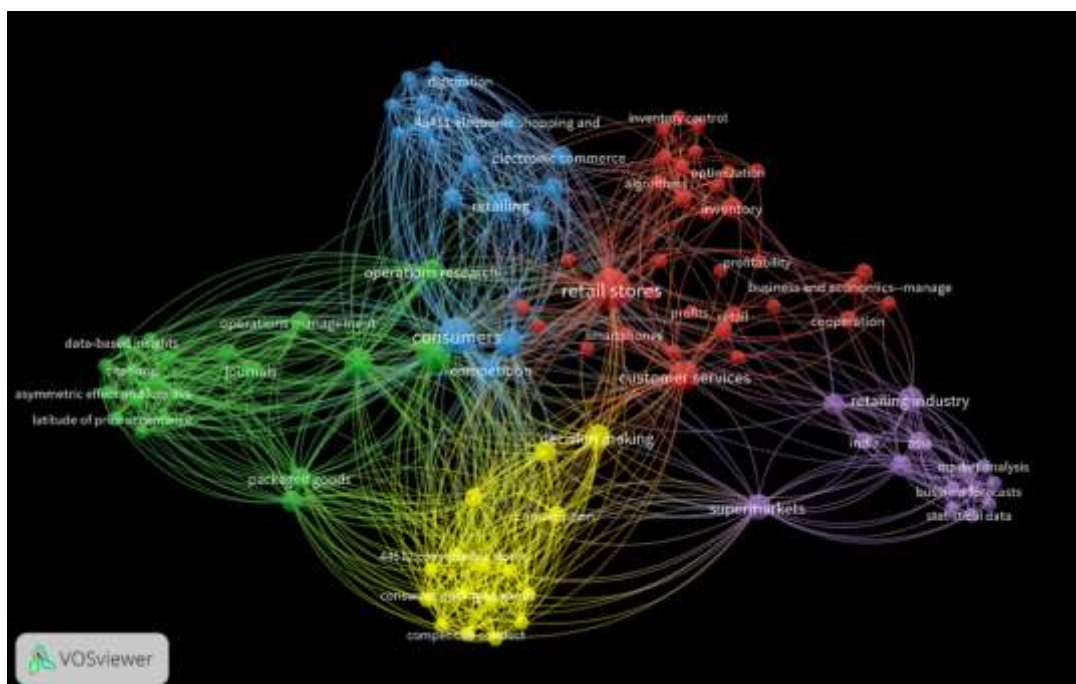
The cluster-1 (blue) has "perceptions" as a central node and groups together other keywords such as "pricing policies," "packed goods," and "marketing," "business and economics"... Thus, the cluster is related to perceptions of customers in their purchasing behaviour.

The cluster-2 (red) has "retail stores" as a central node and groups together other keywords such as "pricing policies," "big data," and "electronic commerce," "competition"... Thus, the cluster is related to retailers and significant data evolution.

The cluster-3 (green) has "supermarkets" as a central node and groups together other keywords such as "customer service," "covid -19," and "retail industry," "India"... Thus, the cluster is related to the retail industry pre & post covid.

The cluster-4 (yellow) has "decision making" as a central node and groups together other keywords such as "shopping," "consumption," and "retail," "theories"... Thus, the cluster is related to customers and their purchasing experience & behaviour.

Analysis with more co-occurrences



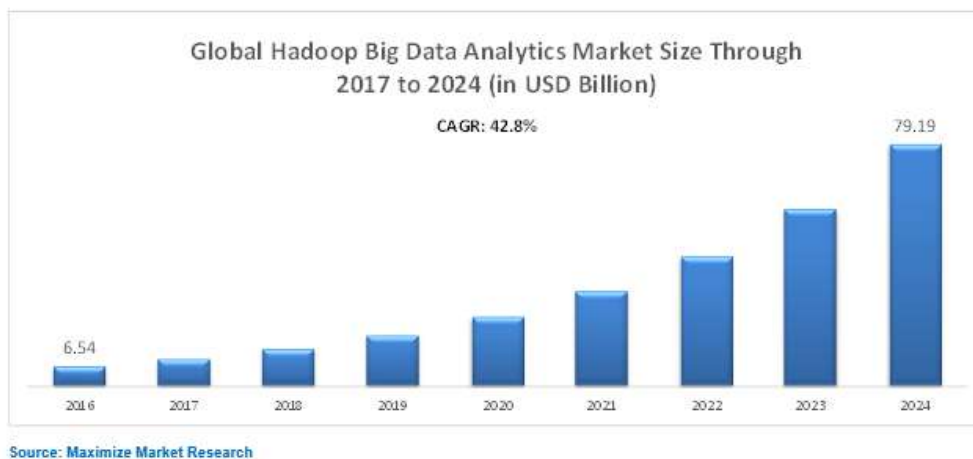
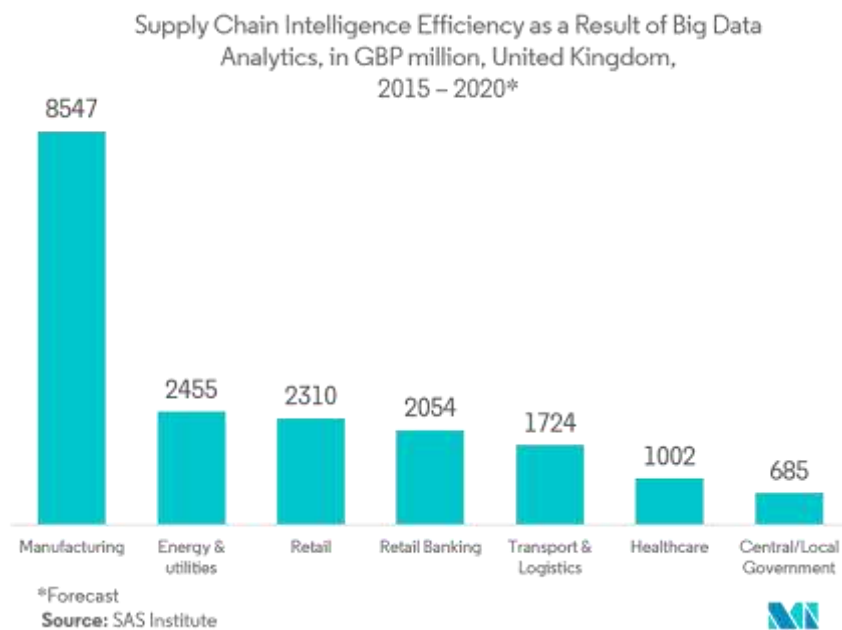
The analysis of the co-occurrence of keywords is similar to that of titles and abstracts in the dominance of the reviewed studies on big data and its impact on the retail industry, thus increasing confidence in the results. Accordingly, three fundamental areas can be identified: consumer behaviour and technology use; purchasing and handling necessities, particularly food; and consumer subject to internal and external (micro and macro) forces. A possible fourth area may induce a discrepancy, emphasising the keyword analysis on the decision-making process and the analysis of titles and abstracts in panic purchases.

MACRO-ENVIRONMENTAL FACTORS

Macro-environmental factors affect the entire analytical micro-environment. In this study, the micro-environment is built around the consumer, the centre of the analysis. The consumer micro-environment is formed by organisations and groups of people close to the consumer (e.g., companies, the media, family, and friends).

Regarding COVID-19 and consumer behaviour, five macro forces are fundamental: the COVID-19 pandemic and the technological, political-legal, economic, and socio-cultural environments. High importance is attached to COVID-19, the technical background, and the politico-legal environment. Various studies indicate how COVID-19 and available technology confluence have induced consumers to rapidly adopt technologies and increase their consumption of highly digital business formats. Specifically, e-commerce and business platform formats solved possible shortage problems and allowed consumers to accumulate products. Further, the technology allowed social lives to thrive amidst the pandemic, reflecting the increased use of social media platforms.

SALIENT CONCLUSIONS



Big Data analytics are used throughout retail to understand customer behaviour, predict demand, and optimise pricing. Most retail Big Data applications are for system-wide cost reduction, improving online and in-store customer experience, and data-driven adaptive supply chains. Big data analytics in retail are used for merchandising and supply chain analytics, social media analytics, customer analytics, and operational intelligence in SMEs and large-scale organisations.

Marketing and supply chain analytics Significant share expected
E-commerce has hurt traditional brick-and-mortar retailers, marking a data-driven retail revolution.

An efficient supply chain moves goods from supplier to warehouse to store to customer. Big data analytics is revolutionising the retail supply chain by tracking product flow and stock levels in real-time, using customer data to predict buying patterns and robots to fulfil orders in vast automated warehouses tirelessly.

Following the manufacturing and energy sectors, supply chain Big Data analytics for retail is expected to grow significantly in the UK.

Predictive analytics and AI will likely revolutionise the retail supply chain.

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