Digital Transformation in E-Commerce Through Industry 5.0: Critical Evidence of Customer's Satisfaction

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Abstract

The stimulated evolution of technology, often referred to as Industry 5.0, is ready to revolutionise global industries. In this era of advanced automation, robotics, and data-driven insights, the E-Commerce industry has the potential to gain the most from these transformative forces. This study examines the profound impact of Industry 5.0 on the E-Commerce surroundings, with an emphasis on technological innovations and their crucial role in enhancing consumer satisfaction. The importance of the alignment between the innovations made in Industry 5.0 and the engagement of customers is growing as e-commerce continues to increase its presence around the globe. This research focuses light on the symbiotic relationship that exists between technology and the satisfaction of customers It highlights the positive experiences that customers could anticipate as well as the advantages that businesses who effectively manage this change will have over their competitors. The research investigates a variety of ways in which Industry 5.0 will have an impact, including the introduction of personalised shopping experiences made possible by advanced analysis and the enhancement of supply chain operations made possible by real-time data insights.

Keywords: Industry 5.0, E-Commerce, Digital Transformation, Customer Satisfaction, Innovation.

Introduction

The tremendous rise in industrial output that we have recently accomplished is made possible by numerous technological improvements. The substantial rise in industrial output sets off a chain reaction across a wide range of firms and industries. There is now availability of new products in huge quantities. The supply and demand relationships for a diverse range of products and services are always shifting. There is a continuous entry of newly established enterprises. Businesses that already exist change. New industries are always emerging, while others fall by the wayside. There have been observations of shifts in the inter and intra industrial interactions. Research in the fields of science and technology qualify for financial support for additional study. The society is impacted in a variety of ways because of these developments. Because of this, we refer to this period as the Industrial Revolution.

Industry 5.0, which is frequently referred to as the "Human-Tech Collaborative Revolution," represents a departure from the exclusively automated processes of its predecessors. It incorporates the convergence of cutting-edge technologies, such as AI, IoT, big data, and robotics, while emphasising the importance of human expertise, creativity, and collaboration. It is a vision in which advanced machines labour alongside skilled labourers and digital prowess augments rather than supplants human capabilities. Industry 5.0, also known as the "Intelligent Industry," incorporates cutting-edge technologies like artificial intelligence (AI), the Internet of Things (IoT), and automation into manufacturing and operations. In contrast to its beginnings, Industry 5.0 prioritises human collaboration and creativity in addition to advancements in technology. The combination of human intelligence and technological expertise opens the way for the transformation of numerous industries, including e-commerce.The E-Commerce sector has witnessed significant expansion, facilitated by the internet, and has become an essential component of modern consumer behaviour. Today's consumers desire seamless

experiences, personalised interactions, and the ability to shop from any location at any time. Industry 5.0 initiates in a new era of innovation in which these goals can be realised through the incorporation of cutting-edge technologies. This integration aims to redefine how businesses and customers interact in the digital domain, not just automate processes. This transformational shift is especially significant for the e-commerce industry, which is profoundly ingrained in contemporary consumer behaviour. E-commerce has transformed from a novelty into a global force, influencing how people discover, purchase, and interact with goods and services. The emergence of Industry 5.0 introduces an entirely new dimension to this environment, presenting both unmatched opportunities and difficult obstacles.

In the modern era of Industry 5.0, the future as a result of the domain of e-commerce is characterised by a limitless number of opportunities. Automated systems that are backed with artificial intelligence are capable of processing and analysing massive datasets in real time. This gives organisations the ability to gain several insights that were previously inconceivable. The Internet of Things marks the start in a previously unseen level of connectivity, allowing for seamless communication between intelligent gadgets in an effort to streamline supply chains, improve inventory management, and even anticipate the preferences of individual customers.
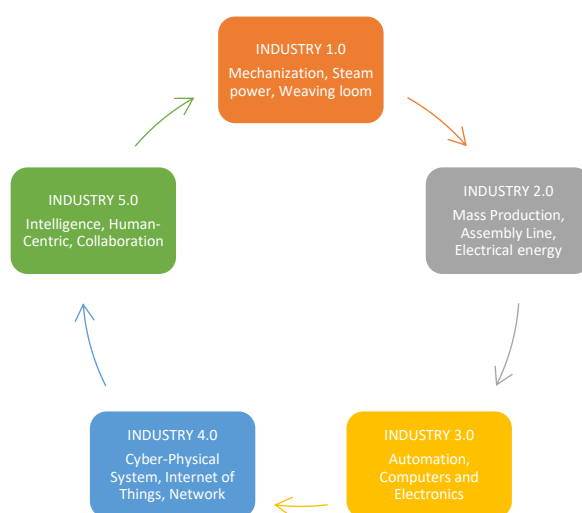
History Of Industrial Revolution

First Industrial Revolution (Late 18th to Early 19th Century):

The first Industrial Revolution marked the transition from agricultural and artisanal economies to factory-based, mechanised production. The invention of machinery, such as the spinning jenny and the steam engine, transformed the manufacturing industry. Although this period had no direct effect on E-commerce as we know it today, it set the groundwork for mass production and the creation of larger quantities of goods.

Second Industrial Revolution (Late 19th to Early 20th Century):

Significant advances were made in the areas of transportation, communication, and energy production as a result of the Second Industrial Revolution. Both the growth of the railway network and the development of the telegraph ultimately led to improvements in the speed and effectiveness of communication and the movement of products. During this time period, the concept of distance selling, which is the foundation of current E-commerce, gave birth to mail-order catalogues. These catalogues allowed customers to purchase goods without physically being there.

Source: Fig. 1 Prepared by Author

Third Industrial Revolution (Mid to Late 20th Century):

The widespread use of computers, digital technology, and the internet were all trademarks of the Third Industrial Revolution, which occurred in the middle to late parts of the 20th century. This revolution is also sometimes referred to as the Digital Revolution. In the latter half of the 20th century, the initial steps towards the

development of E-commerce were taken with the introduction of online transactions and electronic data interchange (EDI) systems, which made it possible for firms to electronically trade documents. The advent of the World Wide Web in the 1990s, on the other hand, was the spark that ignited the flames of the E-commerce revolution.

Fourth Industrial Revolution (Current Era - Ongoing):

The convergence of physical, digital, and biological technology is one of the highlights of the current stage of the Fourth Industrial Revolution, which is denoted by the term Industry 4.0. E-commerce has been at the leading edge of this transition, utilising cutting-edge technology such as artificial intelligence (AI), the internet of things (IoT), big data analytics, and automation to revolutionise the customer experience as well as business processes.

Fifth Industrial Revolution (Emerging Era):

The idea of the Fifth Industrial Revolution is still developing, but it is projected that it will further eliminate the borders between the physical, digital, and biological domains. This will occur despite the fact that the notion of the Fifth Industrial Revolution is still developing. Industry 5.0 places an emphasis on the harmonious collaboration between humans and technology, with the end goal of producing experiences that are more personalised and interactive. This might mean improved customer interactions for online retailers, such as through chatbots powered by artificial intelligence; augmented reality product testing; and even more streamlined supply chains.

E-commerce has gone from having small beginnings to becoming a global phenomenon that is present in all aspects of our life throughout the course of these industrial revolutions. This journey has been characterised by the increasing incorporation of technology, the democratisation of online selling through the use of platforms, and the ongoing reinvention of how businesses and customers interact in the digital age. E-commerce has reached new heights as a result of each revolution, which has helped redefine the possibilities of trade and business in an increasingly interconnected globe.

Comparison of Industry 4.0 and Industry 5.0 in E-commerce

Table 1

Characteristics of Industry 4.0 in E-commerce	Characteristics of Industry 5.0 in E-commerce
• Automation-driven processes	• Human-technology collaboration
• Data-driven decision-making	• Customer-centric personalization
• Focus on efficiency and optimization	• Integration of AI and human creativity
• IoT-enabled supply chains	• Enhanced customer experiences

Source: Prepared by Author

Future prospects of Industry 5.0 in the E-Commerce industry

The combination of sophisticated technologies, automation, and human-centred approaches possesses the capacity to transform how E-Commerce operates and provide value to both businesses and consumers. Here are some important future considerations:

Hyper-Personalization: Industry 5.0 will enable E-Commerce platforms to collect vast quantities of consumer interaction and behaviour data. This information can be used to create highly personalised purchasing experiences, individualised product suggestions, and targeted marketing campaigns. E-Commerce platforms will facilitate more pertinent and gratifying interactions with customers.

Smarter Warehousing and Logistics: Robotics, AI, and Internet of Things (IoT) devices will transform warehouse and logistics operations. Inventory management, order fulfilment, and last-mile delivery can be conducted with the support of autonomous robotics and drones. This will speed up order fulfilment and decrease operational expenses.

Augmented Reality (AR) and Virtual Reality (VR): Through AR and VR technologies, Industry 5.0 can improve the online purchasing experience. Customers will be able to virtually try on products, visualise how

furniture will fit in their residences, and view cosmetics before making a purchase. This immersive experience can increase customer trust and decrease the likelihood of returns.

Real-Time Supply Chain Management: Internet of Things (IoT) sensors and blockchain technology can facilitate real-time product tracking and tracing throughout the supply chain. This transparency will increase confidence and aid in the prevention of counterfeit goods. It will also improve sustainability initiatives by enabling customers to trace the origin of products.

Smart Customer Service: The advanced features of chatbots and virtual assistants powered by AI and natural language processing will increase. They will provide immediate and accurate responses to customer inquiries, thereby contributing to an increase in customer satisfaction and a reduction in the caseload of customer service teams.

Customization and Collaborative Manufacturing: Industry 5.0 can enable more collaborative manufacturing processes. Customers could customise products through E-Commerce platforms, and manufacturers could produce these products using flexible and automated production lines.

Data-Driven Decision Making: The abundance of data generated by Industry 5.0 technologies will enable E-Commerce companies to make informed decisions. Predictive analytics and machine learning algorithms are expected to provide assistance in the task of the identification of market trends, the forecasting of demand, and the optimisation of pricing strategies.

Sustainability and Green Practises: Industry 5.0 can contribute to the advancement of sustainable E-Commerce practices. By optimising supply chains, reducing energy consumption through automation, and implementing intelligent packaging solutions, the Industry has the ability to decrease its environmental impact.

Review Of Literature

P. K. Reddy (2021), Industry 5.0: A Survey on Enabling Technologies and Potential Applications. The concept of Industry 5.0 aims to achieve a harmonious integration of human and machine capabilities inside the workplace, with a focus on optimizing productivity and efficiency. These include concerns regarding security, privacy, the collaboration between humans and robots within a factory setting, scalability, and the availability of a proficient workforce. To fully utilise the full potential of Industry 5.0, the manufacturing sector must be better managed to reduce its environmental impact.

P. Skobelev (2021), On the way from Industry 4.0 to Industry 5.0: from digital manufacturing to digital society. The presented analysis suggests that the ever-increasing appeal of digital economies along with a huge variety of practical applications have established an excellent foundation for the development of technologies associated with Industry 4.0, which are now in use and, in the long run, have the potential to act as a launching pad for the development of Society 5.0.

F. Aslam (2020), Innovation in the Era of IoT and Industry 5.0: Absolute Innovation Management (AIM) Framework. In the context of absolute innovation management, the organization will strategically accept innovation management, merging it into the daily operations of the firm rather than approaching it as an independent initiative requiring separate management. Within the framework of absolute innovation management, the integration of innovation management into an organization's strategic vision and goal is crucial, as it establishes a foundation for fostering innovation throughout the business.

A. Shaji (2020), Industrial Revolution 5.0: The Transformation of The Modern Manufacturing Process to Enable Man and Machine to Work Hand in Hand. This study covers the potential issues that could arise from humans and robots operating together. Legal, social, regulatory, and ethical concerns are among the most essential factors to consider. Moreover, the altering roles of human resources (HR) and information technology (IT) departments have led to a variety of personal preferences regarding working with robots.

Saeid Nahavandi (2019), Industry 5.0-A Human-Centric Solution. The arrival of the Fifth Industrial Revolution will occur when the three primary components, namely intelligent devices, intelligent systems, and intelligent automation, effortlessly interact with the tangible world in collaboration with human intelligence. The concept of "automation" refers to the integration of autonomous robots as intelligent entities that work together with

humans within the same physical environment. The establishment of reliability and confidence among the involved parties can lead to enhanced efficiency, excellent production, less waste, and the flexibility to customize manufacturing processes.

V. Ozdemir (2018), Birth of Industry 5.0: Making Sense of Big Data with Artificial Intelligence, "The Internet of Things" and Next-Generation Technology Policy. Industry 5.0 includes the development of complex and highly interconnected digital networks while ensuring the enduring safety and sustainability of an innovation ecosystem and its components. Industry 5.0 is expected to utilize advanced automation and Big Data while prioritizing safety, innovative technology policy, and responsible implementation science. This will be made possible through the utilization of 3D symmetry in the design of innovation networks.

Research Gap

There is a growing amount of literature on how Industry 4.0 will affect E-Commerce and customer satisfaction, but very little actual study has been conducted on the transformative potential of Industry 5.0 on customer engagement strategies in the E-Commerce industry. The majority of the previous studies have concentrated on the automation and efficiency aspects of Industry 4.0, which frequently disregards the emphasis on human-technology collaboration in Industry 5.0. Consequently, it's important to find out how the incorporation of Industry 5.0 innovations, such as AI-driven personalization and augmented reality experiences, can reshape E-Commerce consumer engagement strategies to create enhanced, customised, and emotionally engaging interactions.

Objectives

- Examine the Transition in E-Commerce from Industry 4.0 to Industry 5.0.
- Impact of Industry 5.0 on Customer Satisfaction.

Research Methodology

The literature study entails an in-depth review of important papers, journals, and websites. Subsequently, in alignment with the stated elements necessary for attaining the research purpose, data is collected from customers of different backgrounds. The data collection methodology mainly involves the collection of data from primary sources, supported with the utilisation of a structured questionnaire created through the Google Forms platform. The sample has been selected on a non-probability-based Convenience sampling method.

Data Analysis

A survey was conducted with a sample size of 60 individuals, with a response rate of 100%. Out of the total participants, 51.7% identified as male while 48.3% identified as female.

| Age	Percentage	Qualification	Percentage
18 years - 25 years	41.7%	Intermediate	3.3%
25 years - 35 years	46.7%	Bachelor's Degree	50%
35 years - 45 years	10%	Master's Degree	30%
45 years - 55 years	1.7%	Professional Degree	15%
55 years and above	0%	PhD	1.7%

- The age group with the highest number of participants was individuals between the ages of 25 years to 35 years, constituting 46.7% of the total. This was followed by individuals aged 18 years to 25 years, resulting in 41.7% of the participants. Lastly, individuals aged 35 years to 45 years represented an additional 10% of the total. The age group of 45 years to 55 years exhibited the lowest percentage, just 1.7%.
- The most participants had Bachelor's degree (50%), followed by Master's degree (30%) and professional degrees (15%).
- According to the survey results, 51.70% of respondents said they engage in occasional online shopping, while 30% indicated a high frequency of online shopping. Additionally, 15% of participants reported rarely dealing in online shopping.

- Survey found that approximately 41.7% of all participants had a certain level of familiarity with the concepts of Industry 5.0, while the remaining 35% were completely unfamiliar with this term. In addition, 23.30% of the participants acknowledged a lack of clarity about their understanding of the concept of Industry 5.0.
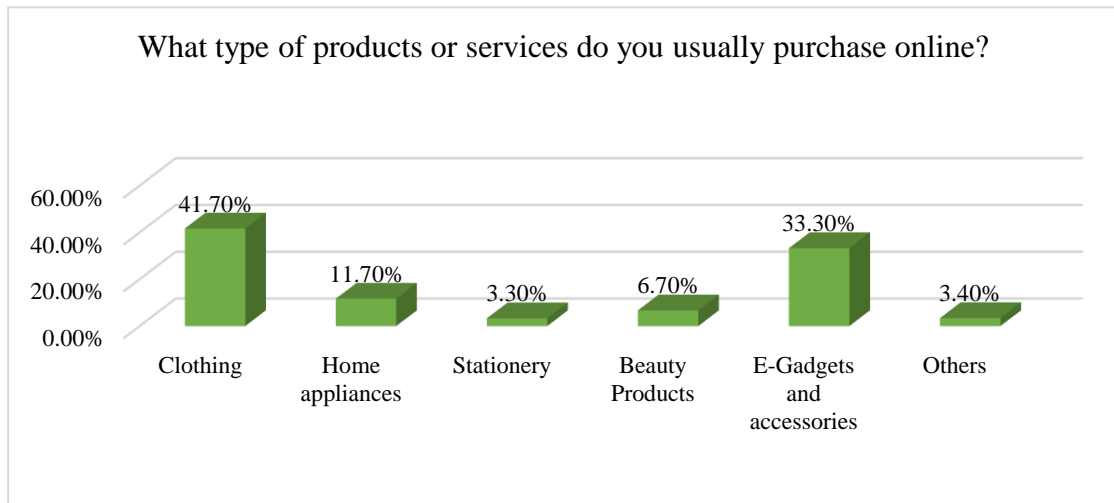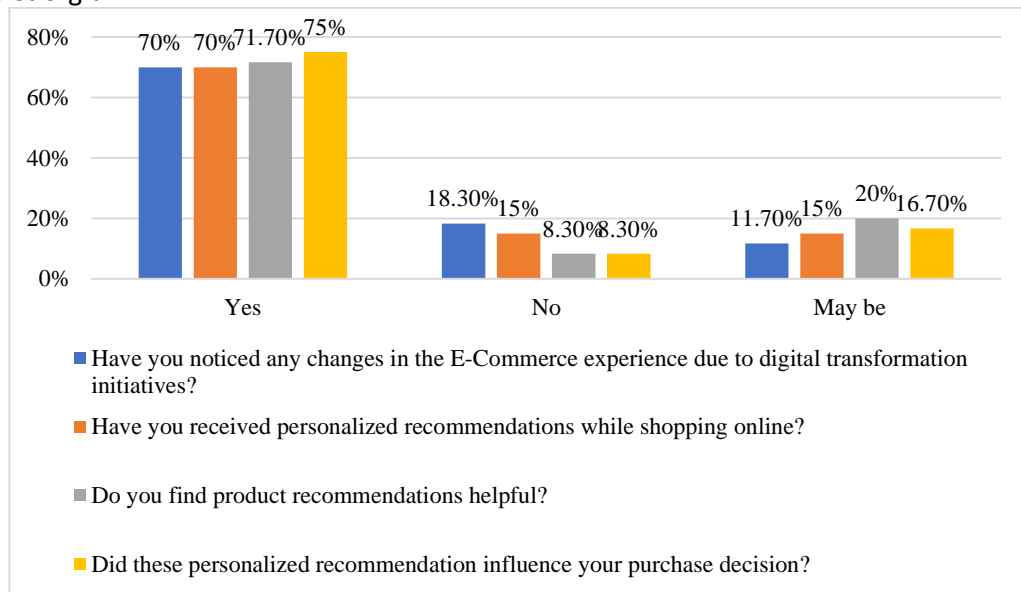

Source: Fig. 2 Prepared by Author

- Within the sample population, around 41.70% of individuals use their money for the purchase of clothing, followed by 33.30% who purchase E-gadgets and accessories. Subsequently, 11.70% of participants invest in home appliances, while 6.70% spend their money towards beauty and personal care products. Lastly, a smaller proportion of individuals demonstrate interest in stationary and other products.
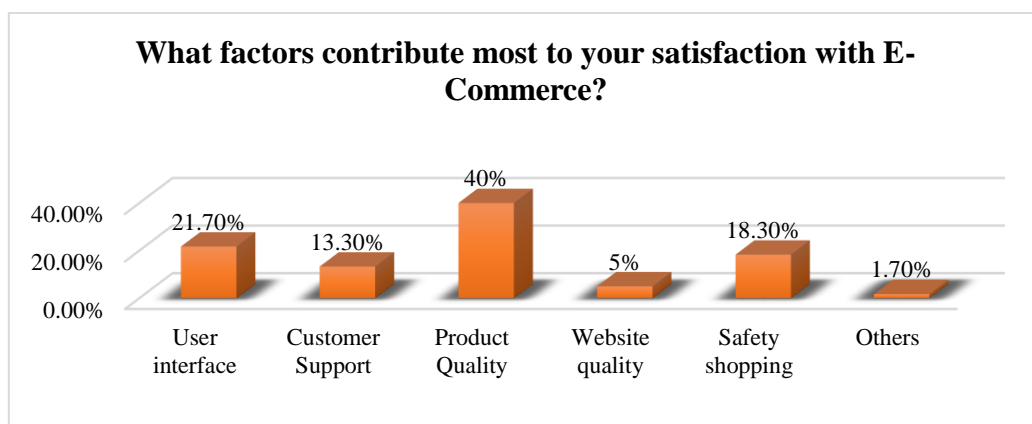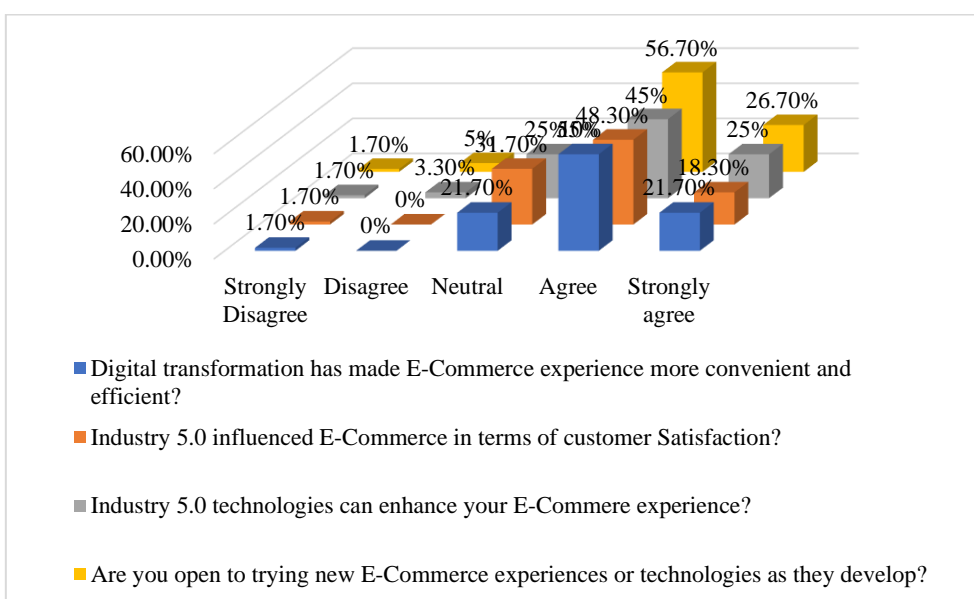

Source: Fig. 3 Prepared by Author

- One of the main factors of the customer's satisfaction in the field of E-Commerce is product quality, which contributes to approximately 40% of the overall impact Additionally, approximately 21.70% of customers attribute their satisfaction with E-Commerce to the user interface. Subsequently, a notable proportion of 18.30% of respondents express that the aspect of safety throughout the shopping experience holds significant importance in determining customer's satisfaction. customer support and website quality are two significant aspects that contribute to customer's satisfaction in the field of E-Commerce. Customer support accounts for 13.30% of the overall customer's satisfaction, while website quality contributes 5% to the overall customer's satisfaction in this context.

Source: Fig. 4 Prepared by Author

- A major proportion, around 70%, of persons say they have experienced favourable transformations due to the process of digitalizing E-Commerce. It has been reported that approximately 18.30% of people claim they have not noticed any noticeable changes in their E-Commerce shopping experiences.

- According to a survey, 70% of respondents said they got customized recommendations on the website, while 15% indicated that they did not receive any personalized recommendations during their online buying experience.

- Approximately 71.70% of participants in the study provided feedback that the recommendations they received regarding the product were highly beneficial, whereas 15% of respondents reported receiving no support from those recommendations.

- Approximately 75% of the participants in this survey expressed that the customized recommendations they received significantly influenced their shopping decisions. In contrast, 8.30% of the participants reported that these personalized recommendations had no significant effect on their purchasing decisions.

Source: Fig. 5 Prepared by Author

- A significant proportion of the respondents expressed their viewpoint that digital transformation has significantly enhanced the convenience of the E-Commerce experience, resulting in increased efficiency. Specifically, over 76.70% of respondents have this view, while approximately 21.70% remain indifferent on the topic.

- Approximately 66.6% of the participants individual shared growth of Industry 5.0 significantly influences customer satisfaction in the context of E-Commerce alternatively, around 31.70% of individuals study findings suggest impact of Industry 5.0 on customer satisfaction may be uncertain or unclear.

- According to a survey, 60% of individuals express the belief that Industry 5.0 technology possesses the potential to significantly enhance the E-Commerce experience. Conversely, 25% of respondents hold the view that the impact of Industry 5.0 on the E-Commerce experience might differ and may not be as substantial.

- Among the respondents who participated in this study, a significant majority, approximately 83.4%, expressed an interest to adopt emerging technologies as they develop, with the aim of enhancing the E-Commerce experience. Approximately 10% of individuals express a neutral opinion regarding their desire to adopt upcoming technological advancements associated with Industry 5.0.

Conclusion

- The implementation of Industry 5.0 in the field of E-Commerce has emerged as an important driver for enhancing customer's satisfaction. Business enterprises that place emphasis on customization, integration across multiple channels, transparency, safeguarding of data, sustainability, innovation, analytics, and cooperation are more likely to achieve exceptional results in meeting and exceeds customer requirements within the context of a fast-changing business environment.

- The implementation of Industry 5.0 technologies, such as the Internet of Things (IoT) and blockchain, serves to augment the level of visibility within supply chain operations. Customers prefer transparency when it comes to the manufacturing process of products, the status of delivery, and the sustainability policies employed by businesses. The establishment of transparency develops a sense of trust, which plays a crucial role in enhancing customer's satisfaction.

- The utilization of chatbots, virtual assistants, and AI-driven customer care systems has become trending in the field of E-Commerce. These technologies offer prompt responses to client enquiries, effectively resolving issues. The presence of positive engagements with AI-driven support has an opportunity to have a major impact on customer's satisfaction levels.

- E-Commerce companies that engage in collaborative ecosystems and establish partnerships frequently show expanded product portfolios and enhanced customer experiences. These collaborations having the ability to enhance consumer satisfaction through the provision of a greater variety of products and services.

- The utilization of blockchain technology have the capacity to identify products, particularly in areas that are sensitive to restrictions, such as luxury goods and pharmaceuticals. Industry 5.0 facilitates the application of dynamic pricing techniques that adapt in real-time, considering multiple factors such as demand, inventory levels, and customer behaviour. This enables enterprises to provide customized discounts and incentives, thereby enhancing customer satisfaction through the provision of perceived value.

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