



# Marketing Strategies 4.0: Emerging Trends and Technological Innovations in Marketing

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**Abstract:** Industry 4.0 technologies have revolutionized traditional approaches across various fields of study, leveraging digitalization to promote sustainability and introduce cutting-edge infrastructure. In today's landscape, each organization necessitates a unique marketing approach to address both customer needs and market trends in their offerings. Paramount to the successful execution of such strategies are aspects like customer satisfaction, retention, behavior analysis, profiling, and incentivization systems. Despite limited scholarly attention, this research delves into the comprehensive integration of Industry 4.0 technologies within marketing, reshaping the digital and intelligent milieu. Through meticulous examination, this study delineates the utilization of Industry 4.0 technologies in marketing strategies, encompassing aspects such as tailored customer satisfaction insights, real-time feedback mechanisms through digital infrastructure, predictive analytics for personalized communication, utilization of business intelligence for product/service enhancement, and strategic simulations for iterative product development aligned with consumer and market dynamics. Conclusively, this study proposes a framework and offers key insights for future adoption while upholding sustainability principles.

**Keywords:** Strategies, Incentivization, Paramount.

## I. INTRODUCTION

In today's fiercely competitive manufacturing landscape, the spotlight is on maintenance, driving businesses to embark on digital transformations both technologically and managerially. The digital revolution reshapes lives and workspaces, yet optimism persists regarding the potential of Industry 4.0 for sustainability. Sustainable Development Goal 8 underscores the importance of decent work and economic growth, while SDG9 emphasizes industry, innovation, and infrastructure, spotlighting the urgent need for technological innovation to meet long-term goals across various domains of life.

In the current era of Industry 4.0 and the circular economy, businesses with ethical and eco-conscious practices are highly sought after. However, small and medium-sized enterprises (SMEs), particularly in developing nations like India, face substantial hurdles in adopting Industry 4.0 technologies due to operational and financial constraints. The complexity of developing such technology-oriented systems, including integrating fragmented data sources, deploying advanced machine learning techniques, and creating adaptable digital twins, poses significant challenges.

To stay ahead in this digital age, companies must continuously monitor market dynamics and adapt their strategies accordingly to maintain a sustainable competitive edge. Enhancing marketing performance is pivotal for survival and growth, with customer stratification, retention, profiling, and behavior analysis serving as fundamental elements. Industry 4.0 technologies such as the Internet of Things (IoT), cloud computing, artificial intelligence (AI)/machine learning (ML), big data, blockchain, robotics, digital twins, and the metaverse are instrumental in this pursuit, facilitating real-time monitoring, predictive analytics, intelligent insights, secure transactions, and virtual representations across various sectors.

The implementation of digitalization involves sociotechnical processes at both social and institutional levels, driving the imperative for sustainability. Previous studies underscore the role of digitalization, enabled by Industry 4.0 technologies, in achieving social, economic, and environmental sustainability. This study delves into the integration of Industry 4.0 technologies into marketing strategies, elucidating their significance, applications, and future prospects for sustainability across social, environmental, and economic dimensions.

This study addresses the gap in existing literature by comprehensively examining all Industry 4.0 enabling technologies in the context of marketing, offering insights, applications, and recommendations for future enhancement. The main contributions include highlighting the significance of Industry 4.0 in enhancing marketing strategies from a



sustainability standpoint, detailing the integration of Industry 4.0 technologies into marketing strategies, and offering recommendations for further research and development. The article is structured into various sections covering methodology, the nexus between Industry 4.0 and marketing strategies 4.0, an overview of impacting technologies, detailed exploration of Industry 4.0 technologies applicable to marketing, and recommendations for future investigations and enhancements.

## II. METHODOLOGY

This study leverages challenges identified in prior research and formulates research questions as a basis for investigation. Central to this study is the research question: What influence do Industry 4.0 enabling technologies exert on marketing strategies during the transition from traditional to digital paradigms? To address this inquiry, articles were sourced from reputable databases such as Web of Science, IEEE Explore, and Scopus, employing specific search criteria encompassing logical strings. These strings included combinations such as "Industry 4.0 AND Marketing strategies," "sustainability AND Marketing strategies," and others, applied within search filters of IEEE, Web of Science, and Scopus. Articles were scrutinized based on their relevance to the research question, considering fields like title, abstract, and keywords. The study focused on articles published between 2014 and 2022 in esteemed journals like the Journal of Cleaner Production, International Journal of Information Management, Journal of Interactive Marketing, and others, while also including content from conferences, books, and web links.

Following data acquisition, the study proceeded to analyze prior research and devised a methodology to elucidate the significance of Industry 4.0 enabling technologies within marketing strategies. Initially, an overview of marketing strategies was provided, establishing the necessity of integrating Industry 4.0 technologies. Subsequently, individual Industry 4.0 enabling technologies were explored in terms of their applications within marketing strategies. Lastly, the study deliberated on the discussion points and limitations identified in previous research, culminating in recommendations for future research endeavors.

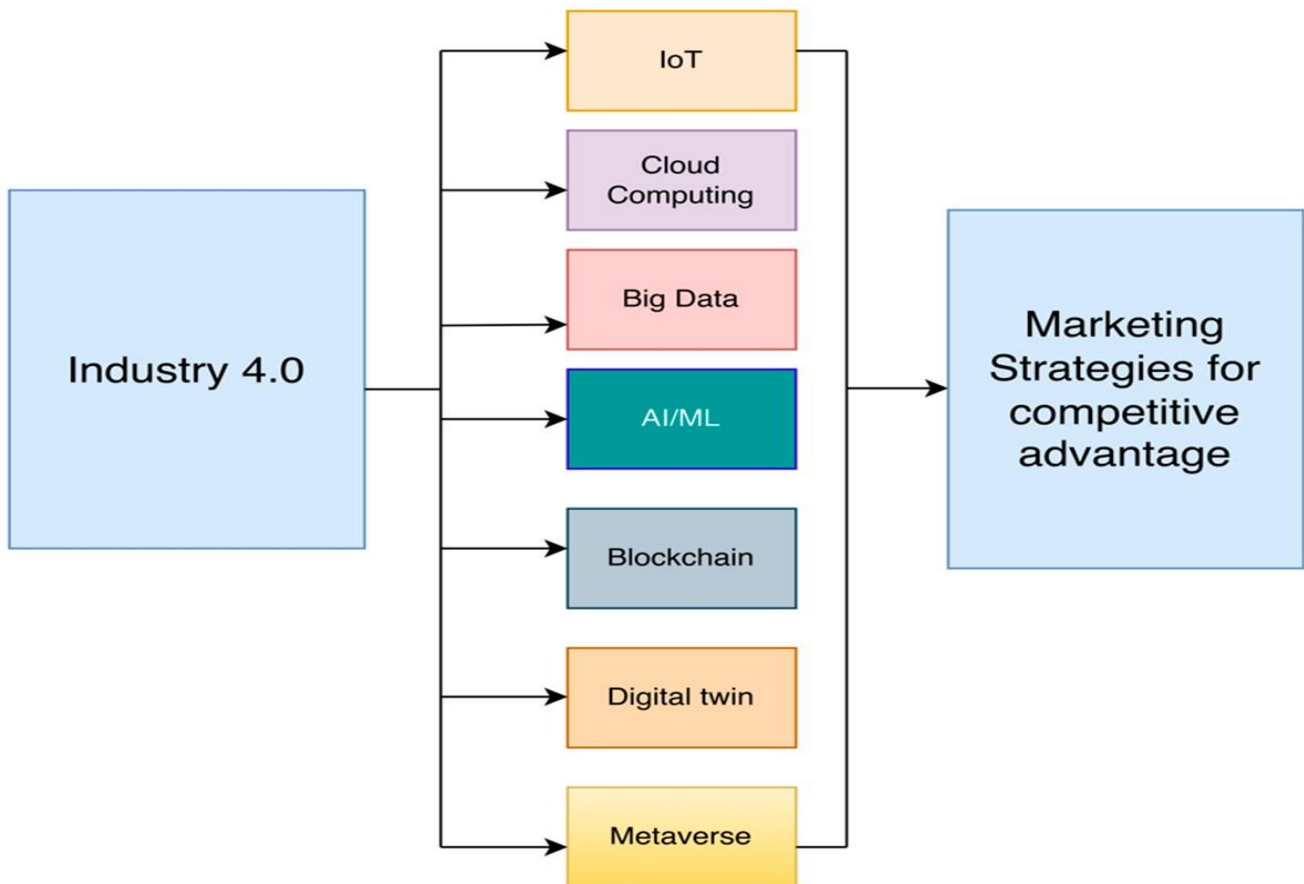
## III. OVERVIEW OF MARKETING STRATEGIES 4.0

The term "Industry 4.0" encompasses a diverse range of contemporary concepts that defy precise categorization within a single discipline [17]. However, it can be understood as a fusion of various technologies such as IoT, cloud computing, big data, AI/ML, blockchain, digital twin, robots/drones, and the metaverse. Industry 4.0 has led to significant advancements across sectors including medicine, management, agriculture, military, and construction, driven by digitization, automation, and increased utilization of information and communications technology (ICT) [18]. The ongoing digital revolution is reshaping both lives and workplaces, with Industry 4.0 holding promise for sustainability [19]. The success of Industry 4.0 is expected to hinge on the collective impact of these technologies.

Marketing, as a business function, entails creating, communicating, and delivering value to customers while managing relationships to benefit the company and its stakeholders. According to Kotler and Keller [20], marketing involves addressing consumer needs while ensuring profitability. It is a dynamic activity influenced by factors like technological advancements, economic fluctuations, conflicts, inflation, and energy constraints. The internet has significantly facilitated the shift towards market-driven marketing approaches, enabling precise gathering of market, customer, and product information [21]. To thrive in the contemporary business landscape, companies must blend digital and traditional marketing methods to cater to client needs effectively [22].

Marketing has evolved significantly from Industry 1.0 to Industry 4.0. Early marketing strategies focused primarily on product-based approaches, aiming to sell goods regardless of market demands [23,24]. With the advent of marketing strategy 2.0, customer demands took center stage, leading to targeted marketing efforts using both online and traditional media [25,26]. Marketing strategy 3.0 emphasized values and people-centric approaches, necessitating continuous market research to align with evolving consumer expectations [27,28]. In the current era of marketing strategy 4.0, personalization based on big data analysis is paramount, integrating offline and online interactions with customers and leveraging technologies like artificial intelligence and machine learning [14]. Understanding consumer behavior and the evolution of marketing applications driven by Industry 4.0 are critical in this dynamic landscape [20].

The rapid evolution of information and communication technologies drives modern marketing strategies, with Industry 4.0 representing the amalgamation and advancement of innovations from previous industrial revolutions [29]. Key technologies influencing marketing strategies include IoT, cloud computing, big data, artificial intelligence/machine learning, blockchain, digital twin, robots/drones, and the metaverse [30]. For instance, IoT aims to provide plug-and-play technology for enhanced user flexibility and remote control [30].



**Figure1.**Technologies of Industry 4.0 that affect Marketing Strategies

Cloud computing, a leading computing paradigm, offers consumers access to flexible and reliable computer environments that can be customized while ensuring quality of service [31]. Big data, another prominent technology, finds application across various industries such as media, telecommunications, healthcare, engineering, and finance, where organizations grapple with vast volumes of data requiring advanced storage, processing, and analysis solutions [32]. Artificial intelligence (AI) encompasses computer modeling of intelligent behavior with minimal human intervention, revolutionizing numerous domains [33]. Blockchain technology has spurred projects across diverse sectors, with cryptocurrencies like bitcoin serving as notable examples [34]. Likewise, robots and digital twins have made significant inroads into various industries. The evolution of digital twins in societal and human contexts is epitomized by the concept of the metaverse [35]. Subsequent sections provide an in-depth exploration of Industry 4.0 technologies employed in marketing strategies.

Delineates the significance of Industry 4.0 technologies both generally and in relation to sustainability. IoT, for instance, is leveraged to gather strategic insights for sustaining long-term customer satisfaction while reducing reliance on paper documentation for this purpose. Cloud computing facilitates the establishment of digital infrastructures for data visualization and monitoring, promoting sustainability through carbon reduction and responsible innovation. AI in marketing strategies enables the creation of artificial agents that recommend marketing actions based on customer, competitor, and organizational data, while also predicting consumer behavior.

Big data drives the extraction of hidden consumer insights and facilitates the implementation of business intelligence to enhance product and service quality within marketing strategies. Blockchain technology empowers the creation of secure digital reward systems based on loyalty points using peer-to-peer networks. Digital twin technology facilitates simulation and testing to identify areas for product improvement, enhancing customer satisfaction and retention. Collectively, these technologies foster the development of digital platforms promoting responsible consumption, production, and infrastructure innovation.



**4.1. IoT and Cloud Computing:** IoT stands as a pivotal technology reshaping marketing solutions across retail, customer relationship management, new product development, distribution, procurement, and promotions. By facilitating the connection of physical devices and enabling information exchange, IoT empowers organizations to strategically enhance efficiency amidst evolving market dynamics, fostering enduring customer relationships [36]. Leveraging IoT, organizations can forecast customer demands by analyzing purchase patterns, leading to value co-creation experiences that significantly influence customers' continuance intention and word-of-mouth recommendations [37]. Mobile commerce experiences a transformative impact through IoT, facilitating data integration based on time, location, and context, aligning with the technology adoption model's emphasis on perceived usefulness and ease of use [38].

IoT-derived data offers insights into customer behavior and product usage, informing product design and enabling businesses to embed IoT devices into market-designed products, thereby ensuring business longevity [40,41]. The integration of IoT, exemplified by IoT-EDF (E-marketing and distribution framework), enhances marketing strategies throughout distribution and procurement stages, bolstering customer retention through robust information utilization [42]. Cloud computing emerges as another indispensable technology, enabling the integration of shared resources in a centralized manner for efficient management and scheduling. E-commerce experiences significant advancements through cloud computing, addressing the burgeoning need for data storage amidst digitalization in marketing endeavors [43]. With advertising transitioning from web 2.0 to web 3.0, cloud computing proves instrumental in targeted marketing efforts, catering to diverse customer purchase behaviors and preferences [44].

The synergy between social media and cloud computing elevates customer experiences, enhancing customer retention by leveraging vast datasets encompassing customer demographics, purchase patterns, and product preferences [45]. Additionally, cloud computing's Software as a Service (SAAS) feature facilitates robust customer relationship management mechanisms within business processes [46]. Green marketing initiatives benefit from cloud computing's capabilities, fostering pollution reduction in production, increasing employee task completion rates, and enhancing organizational brand image [47]. Cloud computing utilization emerges as a potent tool in overcoming marketing barriers encountered by small and medium-sized enterprises (SMEs), both domestically and internationally [48].

**4.2 Big Data:** In the contemporary business landscape, big data stands as a cornerstone of marketing strategies. This disruptive technology has emerged as a crucial tool in decision-making, offering applicability across various facets of the marketing mix, including product, price, place, promotion, and people [49]. With the rise of electronic commerce, organizations can transcend geographical barriers to target any market effectively. The fundamental characteristics of big data, namely velocity, volume, and variety, underscore its significance in modern marketing endeavors [50].

As marketing transitions from offline to online realms, the imperative for robust decision-making grows, necessitating the segmentation of online customers. The wealth of data gleaned from these interactions requires advanced analytics tools like big data for thorough analysis [51]. Social big data, derived from social interactions such as those on social media platforms, presents organizations with invaluable insights for making critical business decisions [52]. The evolution from web 1.0 to web 2.0 technology enables the effective use of big data for Social CRM, fostering enhanced customer engagement and satisfaction [53]. The analysis of online reviews and promotional marketing strategies serves as a reliable indicator of product demand, emphasizing the importance of leveraging big data for understanding market dynamics [54]. This insight allows organizations to adopt a proactive approach to product development, aligning with customer needs and preferences [55]. Figure 2 illustrates how big data can confer a competitive advantage, starting with data acquisition through organizational resources like CRM and culminating in value creation across the 4Ps of marketing. The evolution of big data has proven beneficial for managers, facilitating operational evaluations [56]. However, leveraging big data for decision-making necessitates the effective management of resources—physical, human, and organizational—involved in the collection, storage, and analysis processes [57]. Despite its potential benefits, organizations face a significant challenge in data cleansing, essential for reducing noise and enhancing decision-making efficacy [58].

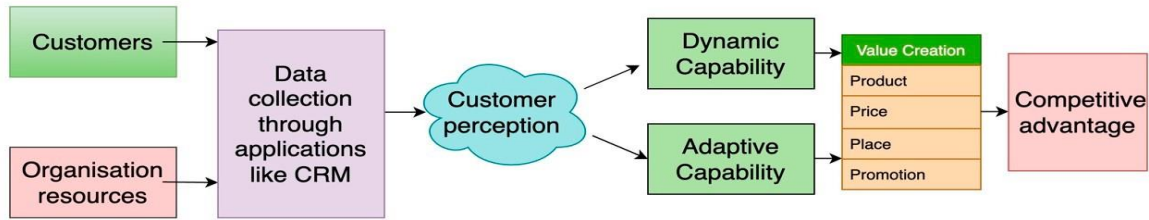


Figure2. Competitive Advantage through Big Data

In addition to the previously discussed areas, big data plays a crucial role in formulating and executing industrial strategies, particularly in business-to-business (B2B) contexts (Figure 3). Organizations can leverage big data to strategically select differentiation, focus, or cost leadership strategies, thus gaining a competitive edge [59]. Here, we introduce a comprehensive framework from prior research [60], delineating components for implementing intelligence and predictive analytics to achieve competitive advantage. This framework facilitates the formulation of essential queries pertinent to leveraging big data for competitive intelligence. These queries encompass determining the types of data to gather, identifying methods for collecting real-time internal and external data, discerning how competitor data translates into meaningful patterns and knowledge, and anticipating the insights required for continuous improvement in competitive intelligence.

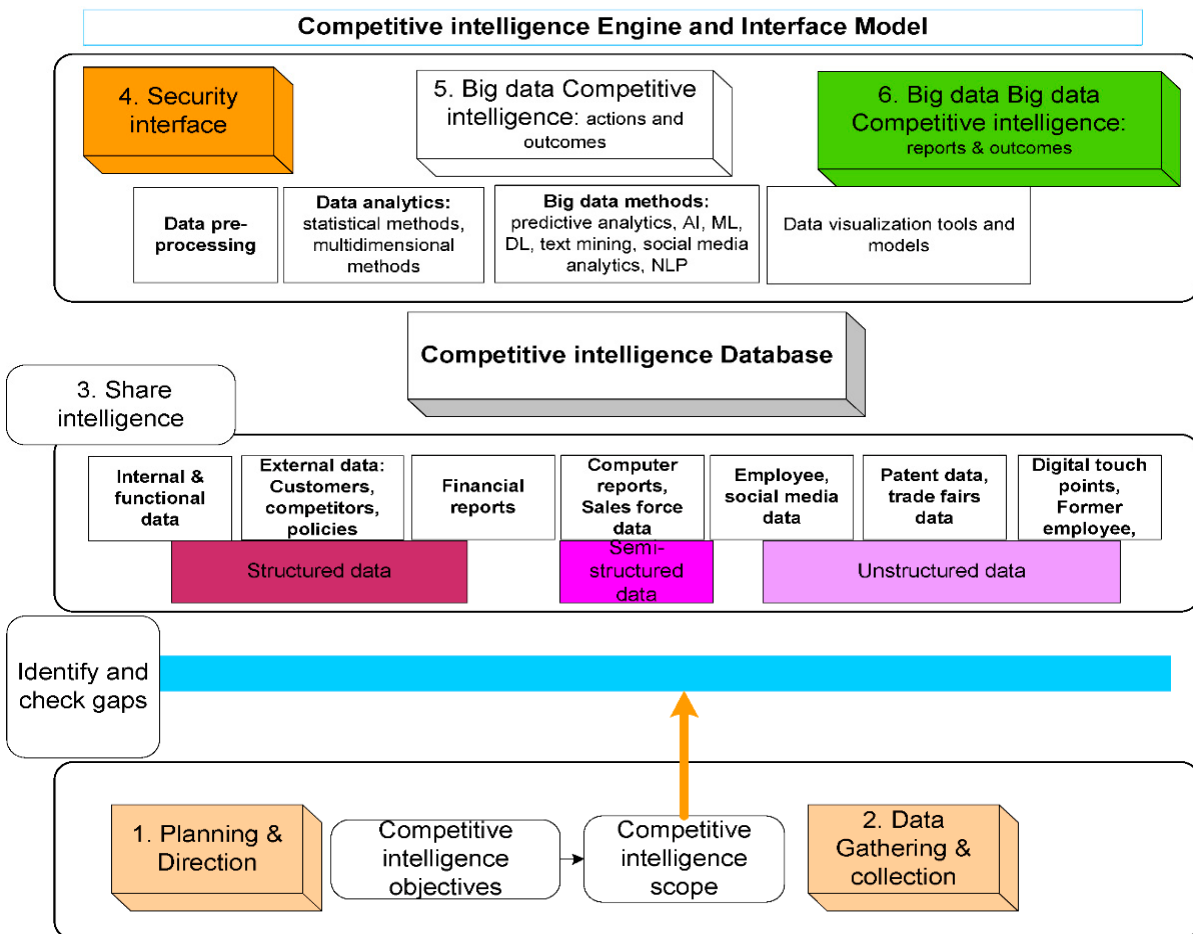


Figure3. Bigdata-based framework for the implementation of competitive intelligence in marketing

4.3 AI/ML: AI/ML has unlocked abundant opportunities in marketing solutions, with a substantial portion of AI research dedicated to elucidating human behaviours and decision-making processes in specific scenarios [61]. By



integrating ML models with AI, strategic decision-making capabilities are enhanced, fostering value creation through four primary avenues:

- Decision support
- Development of new products and services
- Automation
- Enhancement of customer and employee engagement [62].

The evolution of information and communication technology (ICT) has revolutionized the B2B landscape, enabling the collection, storage, and analysis of vast amounts of data, facilitated by technologies like AI/ML [63]. Businesses leveraging customer relationship management (CRM) in B2B contexts stand to benefit from AI-based CRM solutions, enabling effective analysis of complex data for informed decision-making [64]. Furthermore, the pervasive use of AI is particularly evident in the retail sector, where collaboration between AI and human intelligence (HI) promises enhanced implementation and data analysis [66]. In the fourth Industrial Revolution, AI and ML have emerged as valuable tools for anticipating customer needs and meeting their expectations [67].

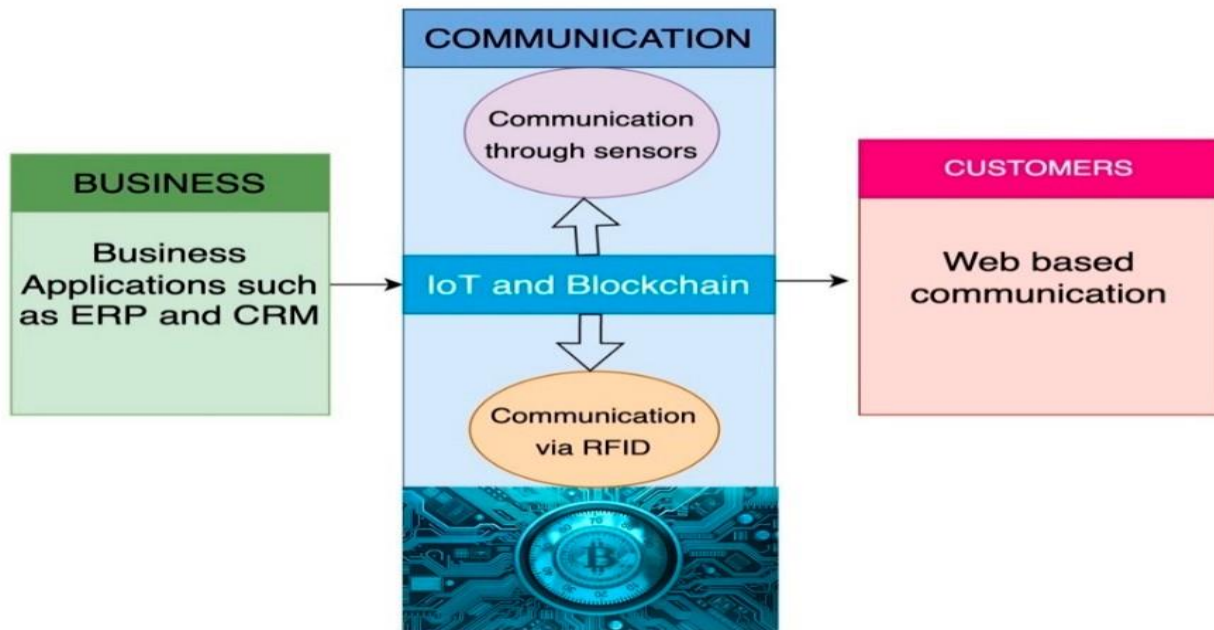
AI/ML's utility extends beyond B2B to B2C scenarios, where machines equipped with advanced learning capabilities outperform those lacking such capabilities, including human beings. Consequently, businesses can analyze customer behavior, attitudes, and purchasing patterns to forecast sales accurately [68]. A case study on a brewing firm demonstrated that AI implementation significantly improved sales by enabling better customer segmentation [69]. Despite the substantial advancements AI/ML has brought to marketing, businesses still grapple with challenges such as a lack of expertise for strategic implementation [70]. Moreover, issues like ill-defined objectives, insecure learning environments, and biased AI pose significant hurdles that necessitate attention to ensure effective AI integration in business processes [71]. It is emphasized that over-reliance on AI alone can have adverse consequences, highlighting the importance of integrating AI with traditional cognitive processes that have proven effective over the years [72].

#### 4.4 Blockchain:

Blockchain is heralded as a transformative tool poised to revolutionize systems across diverse industries, enjoying widespread popularity owing to its robust foundation [73]. Its adoption is driven by the pursuit of common objectives within the ecosystem, extending beyond enhancing corporate efficiency and competitiveness [74]. In marketing, blockchain technology holds promise, particularly in supply chain management and internal control of marketing operations, empowering professionals to fortify internal management systems and marketing initiatives, thereby enhancing businesses' competitive edge [75]. Three key value drivers of blockchain technology underpin its potential to create a competitive advantage in marketing:

- Data ownership
- Reputation
- Tracking and verification [76].

Both online and offline retailing extensively leverage blockchain technology, with applications ranging from facilitating permission marketing for impulse purchases to revitalizing sales for offline/omnichannel companies through digital innovations [80]. The online marketing of agricultural products has similarly experienced significant growth, driven by increased blockchain implementation [81]. Figure 4 illustrates how IoT and blockchain serve as intermediaries between businesses and customers, facilitating the collection of customer information via applications such as ERP and CRM. Leveraging blockchain's distinctive characteristics—openness, decentralization, and permanency—can foster a safer, more client-focused, and transparent marketplace for both consumers and companies [82]. However, given that marketing operations predominantly rely on blockchain as a widely adopted database, the quality of data entered into these databases must be upheld to prevent disruptions across the network [83]



**Figure4.**Communication through IoT and Blockchain

#### 4.5 Digital Twin

A digital twin (DT) serves as a virtual representation or model intricately linked to its physical counterpart through real-time data exchange, mirroring the condition of its physical counterpart in real-time [84]. Originating from the concept of a virtual and physical environment interconnected by data and information flow, the digital twin traces back to the early 2000s when Grieves first proposed it within the realm of product lifecycle management [85]. Augmented by augmented reality, the digital twin emerges as a potent tool, particularly within marketing functions, leveraging the virtual world's capability to interact with the real world through a screen [86].

In the industrial product lifecycle, the digital twin has become indispensable. Previously, simulations relied on various models, but technological advancements now enable organizations to process vast amounts of data, making the digital twin application more effective [87]. Demonstrating its efficacy in value creation and informed decision-making across strategic management realms, the digital twin has become instrumental [88]. Notably, in marketing, the digital twin plays a significant role in identifying customer needs and preferences. Unlike traditional approaches relying on historical data analysis, which can be time-consuming, the digital twin offers real-time consumer feedback, expediting the analysis of their needs and desires [89].

#### 4.6 Robots and Drones

Robots and drones represent a recent stride in the progression of Industry Revolution 4.0. The integration of robotics, AI, and other revolutionary technologies has propelled the development and commercialization of service robots, fostering human-robot interaction (HRI) experiences in service-oriented environments [90]. Over time, the affordability of drones has surged, thanks to notable advancements in technology and ICT [91]. Notably, the hospitality industry has witnessed remarkable robot development, with robots assuming human tasks and striving to deliver superior service to guests. (HRI)—empathy and knowledge sharing [93]. The adoption of service robots in this setting hinges significantly on trust, often ignited by human-like cues mirroring human appearance and social behavior. Thus, robots have become integral in service delivery within the marketing domain [94].

Figure 5 illustrates the three functional domains where robots can be effectively deployed in marketing:

- Addressing customer queries
- Data collection
- Providing customer information

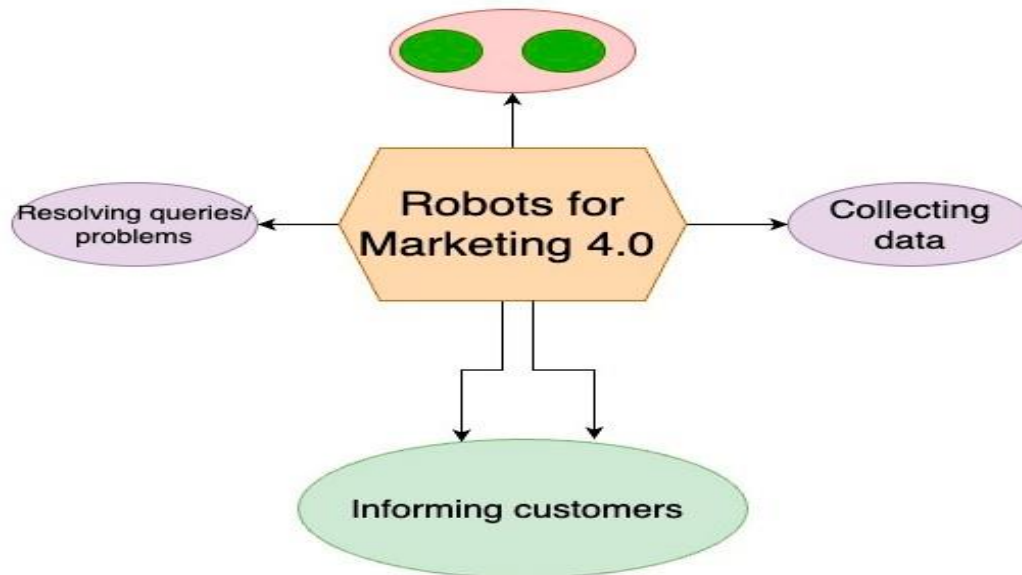


Figure5.Robots in Marketing

Numerous factors influence customer satisfaction regarding robotic service delivery, including the robot's features and its ability to either enhance or detract from service compared to human delivery [95]. Restaurant customers are particularly impacted by the following attributes:

- Intelligence level of the robot
- Likeability of the robot
- Safety assured by the robot
- Anthropomorphism
- Animacy [96]

To ensure customer satisfaction with robotic service delivery in restaurants, organizations should prioritize perceived innovativeness, which cultivates a favorable attitude towards the robot [97]. Similarly, drones represent another prevalent technology in the service industry. Like robots, specific characteristics affect the customer-drone relationship, such as perceived risk, attitude, and perceived benefits [60]. Drones are employed in food delivery services, and models such as the Technology Acceptance Model (TAM) and Technology Planned Behavior should be utilized to ascertain behavioral intentions in the context of food delivery services via drone [98].

#### 4.7 Metaverse

The metaverse represents another significant technological advancement impacting various sectors, with marketing being particularly significant. Through the utilization of augmented and virtual reality technology, the metaverse has the capacity to extend the physical world by facilitating natural interaction in both real and simulated environments, utilizing avatars and holograms [99]. It encompasses a range of virtual reality platforms, primarily utilized within the online gaming sector [100].

Since the onset of the COVID-19 pandemic, there has been increased reliance on metaverse technology, particularly in endeavors that minimize human interaction, such as online education and the heightened use of e-commerce [101]. Retailing has witnessed notable advancements with the emergence of the metaverse. Retailers are increasingly transitioning to metaverse retailing, although this shift necessitates systematic and strategic planning for effective implementation [102]. Moreover, the metaverse finds application in virtual commerce, an evolution of e-commerce, enabling consumers to evaluate products more comprehensively by visualizing them in three dimensions rather than two [103]. Major global brands like Nike have begun leveraging the metaverse, finding it highly interactive due to its provision of 3D digital space [104].

Advertising has also unlocked new opportunities through metaverse technology. Similar to traditional TV or online advertising, platforms such as Metaverse, the advertising network on Second Life, lease out virtual billboards to businesses and track visitor engagement, providing valuable insights to advertisers [105]. Despite the burgeoning popularity of the metaverse, regulatory authorities must maintain vigilance to prevent fraudulent activities [106].





V. DISCUSSION AND RECOMMENDATIONS

Building on the preceding discourse concerning the diverse Industry 4.0 enabling technologies, we now delve into offering significant recommendations for the future incorporation of these technologies, aiming to enhance innovative infrastructure. Figure 6 delineates the diverse functional domains of marketing, encompassing CRM, advertising and promotion, retail, product development, and strategic decision-making, with corresponding technologies deployed in these areas.

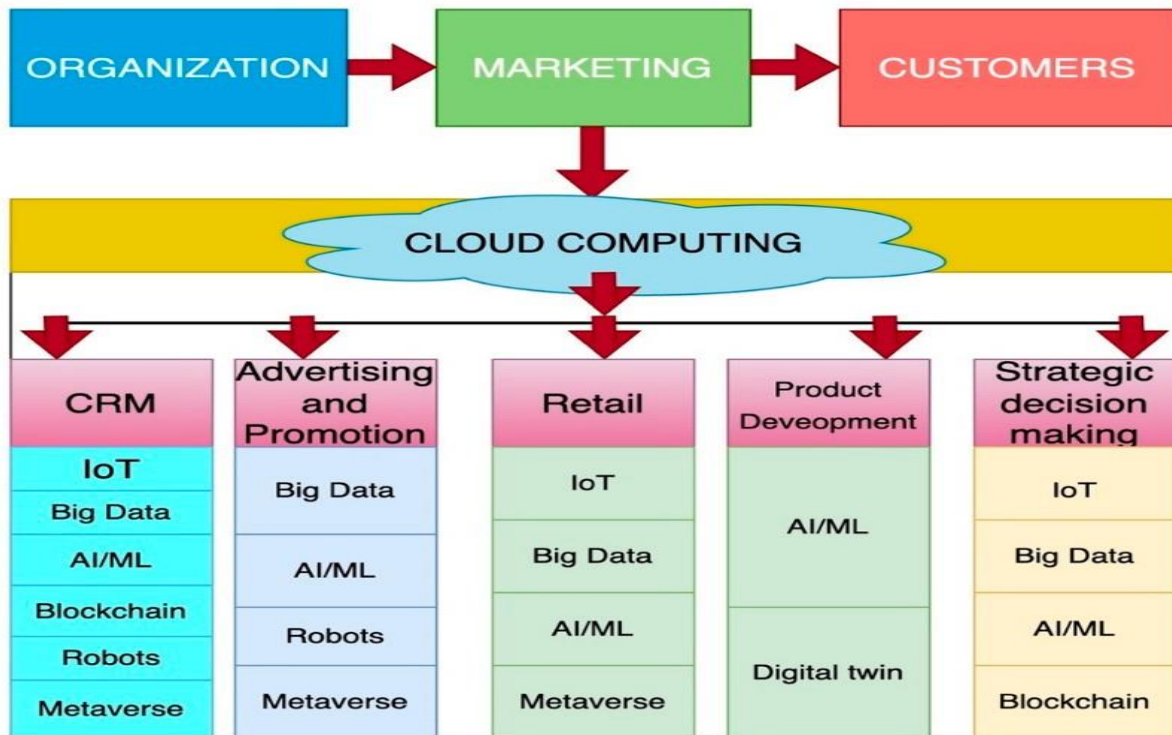


Figure6. Use of technologies in various functions of marketing

The substantial impact of IoT technology on numerous daily activities and potential customer behaviors undoubtedly underscores its significance. Consequently, further research into IoT's influence on customer satisfaction and the effective analysis of customer needs and desires through IoT-generated data warrants attention in future studies.

The integration of cloud technology has effectively addressed a significant portion of challenges encountered by e-commerce merchants in aligning their services with consumer demands. With ample scope for exploration, future research can delve into optimizing cloud technology for effective decision-making among various SMEs. Additionally, studies on enhancing cybersecurity measures while utilizing cloud storage, a current concern for many organizations, merit investigation.

Big data empowers organizations to make informed predictions, particularly in understanding marketing behaviors. However, the adoption and application of Web 2.0 and big data technologies across business functions require comprehensive policies and procedures. Future research could explore innovative models seamlessly integrating data science across design, execution, and measurement aspects of marketing strategies.

AI/ML technology's relevance spans various marketing functions, necessitating an understanding of how managers can devise competitive strategies leveraging the latest AI advancements. Future studies may focus on formulating innovative models seamlessly integrating data science across design, execution, and measurement aspects of marketing strategies.

While blockchain has demonstrated its potential to revolutionize traditional industries, future research could explore methods to maintain security, particularly in the e-commerce sector.



As the digital twin matures from its nascent stage, future research may delve into understanding customer feedback and behaviors to inform business decisions effectively.

Although this article sheds light on the utilization of robots and drones in marketing strategies, particularly within the service industry, future research could explore how robots can provide services to guests effectively while fostering trust.

The emerging metaverse technology presents a novel frontier in marketing, warranting further study to understand its implications for product promotion and consumer behavior. Moreover, future research should investigate the implementation of these technologies and their impact on the relationships between organizations, customers, and stakeholders.

## VI. CONCLUSION

Marketing strategy is pivotal for enhancing organizational productivity. In the current landscape, integrating technological advancements into marketing strategies is imperative to meet customer and market demands while ensuring sustainability. Drawing upon these imperatives and addressing the limitations of prior research, this study explores the incorporation of Industry 4.0 enabling technologies into marketing strategies. Specifically, it examines their applications in customer retention, satisfaction, profiling, and reward systems through loyalty points. The study highlights how Industry 4.0 technologies facilitate strategic information acquisition for enhancing customer satisfaction, establish digital infrastructure for real-time product and service feedback, forecast customer behavior for personalized messaging, leverage business analytics to enhance product/service quality, and develop effective simulations for product enhancements aligned with consumer and market demands. Lastly, the study provides crucial recommendations for future enhancement and adoption to foster innovative infrastructure within a sustainable framework.

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