

Industry 4.0 and Marketing 4.0: The Fourth Industrial Revolution

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Abstract: *The Fourth Industrial Revolution, often known as Industry 4.0, is being propelled by cutting-edge technologies that have a significant impact on both business models and production processes. Disruptive technology and practises have been added during this revolution. These elements of Industry 4.0 have a big impact on marketing and have prompted an evolution to make sure that promotional efforts match up with technical developments and cater to current consumer expectations. This paper's goal is to identify and discuss potential directions for future marketing research in light of the changes brought on by Industry 4.0. The method used in the article is a survey of the pertinent literature with a special emphasis on the main ideas that will be of the utmost significance for future research on Industry 4.0 and marketing. As a result, the most significant peer-reviewed journal database in the academic world, SCOPUS, was used as the foundation for a systematic bibliometric literature evaluation. The study concludes that while there are many potential topics of examination for marketing researchers, the five marketing principles of Industry 4.0—cooperation, communication, co-creation, cognitivity, and connectivity—are the most crucial ones. The quantitative analysis of these five concepts should be the main focus of future research.*

Keywords: Industry 4.0, connectivity, marketing, and technology

I. INTRODUCTION

A new digital industrial revolution known as Industry 4.0, which is characterised by the total digitalization of production processes, has been taking place in recent years. The three previous significant industrial revolutions, known as Industries 1.0, 2.0, and 3.0, all preceded this one. Industry 2.0 was related to the shift to mass production and electrical energy in the 20th century, while Industry 1.0 was focused on the development of steam machines and an increase in industrial activities [1]. The switch from analogue to digital production systems was a part of Industry 3.0. A new technical advancement called "Industry 4.0" enables items to connect and communicate online. Smart manufacturing technologies including additive manufacturing and autonomous robots, cloud computing, augmented reality, big data, and the Internet of Things (IoT) are some of the technologies propelling the development of Industry 4.0 [2]. According to Sterev [3], Industry 4.0 creates a modern business culture by fusing innovations, human capital, and a new entrepreneurial mindset. In order to navigate the complexity of the market, Industry 4.0 has resulted in increased production process flexibility and a focus on client needs and demands. Mehdiabadi et al. [4] add that Industry 4.0 technology helped produce a more individualised and tailored service for every customer.

Industry 4.0's main objective is to alter economic laws, with a particular emphasis on the manufacturing industry. Industry 4.0, in contrast to earlier industrial revolutions, aspires to combine machines, people, and things to create a more networked value chain, making it more complicated [5]. To maximise personalization and improve the effectiveness of the manufacturing processes, organisations use three forms of integration: vertical, horizontal, and end-to-end integration [2]. The importance of social networking via internet technologies and the expanding engagement of consumers in the production process are two key trends linked with Industry 4.0 [6]. The dissemination of knowledge, increased consumer empowerment, and control over purchasing decisions have all been facilitated by developing communication technology. As a result, Industry 4.0 is the advancement and integration of innovations from earlier industrial revolutions.

A future built on intelligent customer management systems, open technologies, and additive manufacturing is what Industry 4.0 offers. As a result, innovative enterprises built on fresh entrepreneurial strategies that take advantage of developing technologies, evolving business models, and operational excellence are the end products of the new

industrial revolution [7]. Because of these characteristics of Industry 4.0, marketing has undergone tremendous change in order to better meet consumers' expectations and keep pace with technical improvements [1]. For instance, modern internet-based communication enables consumers to offer feedback and ideas about a product or a brand, in contrast to traditional marketing, in which consumers passively absorb marketing information. Thus, when creating and executing marketing messages and campaigns, marketers must take into consideration such customer information. According to Ungerman and Ddková [8], merging artificial and machine intelligence improves human-to-human interactions, strengthening consumer contact. In addition, marketing in Industry 4.0 mixes offline and online customer-company interactions to build trusting bonds that advance both professional and personal connections. These results suggest that the subject of Industry 4.0 and marketing, which forms the basis of this research article, has a wide range of potential research directions. Therefore, it is critical to comprehend the profound changes that Industry 4.0 may bring to the marketing industry. In order to help researchers learn how these disruptive technologies from Industry 4.0 can enhance marketing functions to keep up with the quick changes in markets and consumer needs, we have developed a Systematic Bibliometric Literature Review.

II. THEORETICAL FRAMEWORK

2.1. Definitions of Important Terms

2.1.1. Industry 4.0

The phrase "Industry 4.0" was first used in 2011 by the German organisation "Industrie 4.0" to denote a shift in production from mass to personalised methods using cutting-edge, emerging technologies. The association, which was made up of academics, decision-makers, and business leaders, predicted the fourth industrial revolution on the basis of the quick digitization of organisational activities [9]. The primary tenet of Industry 4.0 was that companies operate in the present global markets utilising digital technologies that link equipment, clients, supply chains, manufacturing facilities, and finished goods in order to collect and exchange real-time operational and market data [10]. The "Industry 4.0" idea was originally adopted by the German government and included in the "High-Tech Strategy 2020 for Germany." To assist digital technology in the manufacturing sector, other nations like the UK, USA, France, Italy, and the Netherlands developed Industry 4.0 programmes. These governmental programmes have been crucial in assuring Industry 4.0's quick development throughout the years. For instance, the "Industrie du Futur" (French), "Manufacturing USA" (American), and "Smart Industry" (Dutch) projects provided tax credits and other financial advantages to businesses who adopted industrial practises in line with Industry 4.0 objectives [11]. These tactics encouraged the vertical and horizontal integration of organisational operations while advancing digitisation.

In the course of history, four significant industrial revolutions have been the subject of study and practise. Industry 1.0, which focused on the steam engine and lasted from 1760 to 1840, was followed by Industry 2.0, which featured the use of electricity in industrial operations, in the 19th century [11]. The use of Information and Communication Technologies (ICT) and industrial automation were key components of the third industrial revolution, or Industry 3.0, which began in the 1960s [10]. Industry 4.0, which is still in progress and involves constructing smart factories by fusing digital and physical objects, came after this age of development. The ongoing improvements in manufacturing system connectivity made possible by the integration of IoT, ICT, and machinery in cyber-physical systems (CPS) are the key feature defining this industrial phase [12]. Consequently, the adoption and spread of technologies that result in business digitization might be referred to as Industry 4.0.

Industry 4.0 is the umbrella term for ideas and innovations connected to the transformation of the industrial industry. It denotes the transition from mass manufacturing of goods and services to individualised production based on online and offline data [13]. Industry 4.0, according to Chen [14], entails intelligent digital networking, rule-based, autonomous decision-making, and performance management in businesses at all phases of value creation. Furthermore, Industry 4.0 integrates social, economic, and technological advancements to maximise value creation by utilising data collected both online and offline, according to Buestán et al. [15]. Digital networking links people, machines, and objects to build a networked value chain that speeds up information transmission [16]. In addition, the revolution blends internet technology with improved industrial manufacturing features, resulting in more flexibility throughout the production process [11]. Additionally, it offers ways to meet the unique needs of each client and other stakeholder. Because of this,

Industry 4.0 has given companies new and better options to boost their competitiveness and integrate their product and system improvements with the present, growing changes.

To accomplish the objectives and maximise the prospects presented by Industry 4.0, a variety of technologies are required. These technologies provide answers to a variety of issues, such as production prices and lead times, and they ought to guarantee IT system interoperability [11]. Big Data analytics, cloud computing, augmented reality, cyber security, and additive manufacturing are some of these technologies. Other Industry 4.0 advancements were listed by Ungerman and Ddková [8] and included the Internet of Things (IoT), information and communication technologies (ICT), cyber-physical systems (CPS), enterprise integration (EI), enterprise architecture (EA), and the use of cybernetic systems. These developments have various but interconnected functions in Industry 4.0 and offer many potential to improve business practises at this stage of growth. Innovations like mobile phones and sensors, for instance, are linked to industrial IoT solutions, and big data analytics makes it easier to profile customers [17]. In order to improve the security of the information shared throughout the networked value chain, cyber security solutions are also required. Despite their disparities, these inventions are connected and have mutual influences, which boosts effectiveness and performance.

2.1.2. Marketing 4.0

To create, communicate, and provide value to customers, an organisation must engage in marketing. Marketing is also utilised to control client connections for the benefit of the business and all of its stakeholders. Marketing is the process of determining and meeting customer human and social requirements while preserving the profitability of the business, according to Kotler and Keller [18]. Marketers develop, convey, deliver, and trade offerings that meet the needs of clients, partners, and society as a whole [19]. These justifications lead us to the definition of marketing management as "the art and science of choosing target markets and getting, keeping, and growing customers through creating, delivering, and communicating superior customer value" [18] (p. 26). However, the complexity of consumer tastes and preferences has steadily expanded due to the rapid improvements in technology. As a result, as they are essential for value proposition and delivery, marketing and marketing management functions are routinely modified to account for these developments. As a result, marketing entails adaptable procedures and actions that are often changed to take into account advancements in technology and industry trends.

A dynamic and ever-evolving aspect of business is marketing. Numerous factors affect it, including as advancements in technology, economic downturns, conflicts and war, inflation, and energy shortages. The widespread adoption of the internet and the digitization of company procedures have been two main forces propelling the marketing sector. For instance, Bala and Verma [20] claimed that the internet has significantly aided in the shift to market-driven marketing strategies, which rely on formalised methods of gathering precise and timely data on consumers, the market, goods, and the overall business environment. Online sales and marketing of goods and services are made possible by electronic commerce (e-commerce) thanks to the internet [21]. The beginning of internet-based marketing may be traced to 1990, when people started using websites to inform buyers about their products. Digital marketing has been transformed by businesses like YouTube, Google, Yahoo, Alibaba, and Amazon by enabling trade and enhancing access to product information, advertising space, stock trading, and software.

Industry 4.0 involves the use of numerous digital technologies by businesses and marketing professionals to accomplish marketing goals. Digital marketing is the use of digital technology in marketing activities to match them with customer needs, according to Bala and Verma [20]. Big Data analytics and other Industry 4.0-enabling technologies make it possible to gather and analyse customer and market data for better decision-making and marketing strategy. In order to ensure that customers' expectations are met accurately, businesses must combine traditional and digital marketing methods to flourish in the present business environment [22]. Through online advertising, these businesses are able to develop their brands and generate traffic that helps them succeed. By engaging both current and potential customers, digital marketing offers a more efficient means to reach a larger audience and grow the customer base.

III. CONCLUSION

The purpose of this paper was to lay the groundwork for future research in the field of marketing by providing a thorough analysis and discussion of the academic contributions that have already been made while taking Industry 4.0's

changes into account. Academic research on marketing and Industry 4.0 was examined in order to do this. An integrated future research agenda was presented based on the assessed current state of the literature and the constructed preliminary theoretical framework.

The increased digitization of production processes is a defining characteristic of Industry 4.0. It involves a number of disruptive technologies, including big data, augmented reality, cloud computing, autonomous robotics, and the Internet of Things (IoT), which have significantly altered the business environment. For instance, Industry 4.0 technologies link individuals, entities, and things to form a connected value chain. This integration has had significant effects, one of which is the customer's evolving position in the marketing and production processes. Industry 4.0 marketing strategies call for treating customers as active partners within the digital ecosystem, in contrast to traditional marketing, which saw consumers as passive users of marketing information. Marketers can gather, examine, and evaluate consumer feedback, thoughts, and viewpoints about the brand or its related processes thanks to new communication infrastructures like Big Data analytics. Because of this, the new business models created throughout the industrial revolution are focused on the client and include addressing their wants; as a result, the products and services are more than ever customised and unique to each individual customer.

Only the information processing improvements have a direct impact on marketing, despite the fact that all of the Industry 4.0 technologies have made substantial contributions to the global industrial change. The Internet of Things (IoT), cloud computing, big data analytics, customer profiling, and artificial intelligence (AI) are a few examples of these technologies. These technologies enable businesses to gather, examine, comprehend, and use client information about both offline and online actions. These technologies are interconnected and have mutually beneficial effects, albeit having distinct responsibilities to play in realising the Industry 4.0 vision. Companies must therefore adhere to a number of design principles, such as connectivity, information transparency, and decentralised decision-making. To ensure that all stakeholders have access to the vital information and resources needed to ensure the success of projects, the digital technologies must be properly networked across the internet. Additionally, data transparency attempts to foster effective data interchange among stakeholders in order to foster partnerships based on mutual trust. By redistributing management from the central location, decentralisation of decisions encourages autonomous decision-making and control within subsystems. In addition, under the changing circumstances of Industry 4.0, other principles—like co-creation, cooperation, conversation, cognitivity, and connectivity—create a unique approach to the marketing mix. Co-creation is the foundation of the product creation process because of interconnectivity and data exchange, while mutual communication defines the promotion activities. Similar to this, the ecosystem's players work together to facilitate distribution, and pricing are established using information gleaned through cognitive processes that analyse actual consumer behaviour. When the concept of connection is used, as it entails linking digital technology over the internet, these four marketing principles of Industry 4.0 become applicable.

These elements aid in overcoming the trust issue that threatens Industry 4.0 ideologies' widespread success. However, due to the practical implementation of these disruptive technologies, marketing functions are now more adaptable to the quick changes in markets and consumer demands. We propose conducting quantitative research on the five Industry 4.0 marketing tenets of collaboration, communication, co-creation, cognitivity, and connectivity to advance this effort.

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